

CONNECTICUT RIVER FLOOD CONTROL PROJECT  
**WEST SPRINGFIELD**  
**MASSACHUSETTS**  
WESTFIELD RIVER, MASSACHUSETTS

**SPECIFICATIONS**  
**FOUNDATION**  
**TREATMENT**  
**WEST SPRINGFIELD DIKE**

STA. 56+87 TO AGAWAM BRIDGE

ITEM W. S. 8 - CONTRACT



NEW ENGLAND DIVISION - CORPS OF ENGINEERS - WAR DEPARTMENT

BOSTON, MASSACHUSETTS

MARCH 1947

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR CONSTRUCTION OF

WEST SPRINGFIELD DIKE - FOUNDATION TREATMENT

STATION 56+87 TO AGAWAM BRIDGE

WESTFIELD RIVER, MASSACHUSETTS

10 MARCH 1947

NEW ENGLAND DIVISION

CORPS OF ENGINEERS / WAR DEPARTMENT

BOSTON, MASSACHUSETTS

Bid No. \_\_\_\_\_ Bidder \_\_\_\_\_  
(Do not write above this line)

Serial No. 19-016-47-27

INVITATION FOR BIDS  
(CONSTRUCTION CONTRACT)

NEW ENGLAND DIVISION  
CORPS OF ENGINEERS  
WAR DEPARTMENT  
31 ST. JAMES AVENUE  
BOSTON 16, MASS.  
10 MARCH 1947

Project: CONSTRUCTION OF WEST SPRINGFIELD DIKE - FOUNDATION TREATMENT,  
STATION 56+87 TO AGAWAM BRIDGE, WESTFIELD RIVER, MASSACHUSETTS.

1. Sealed bids, in duplicate, will be received until 2:00 P.M., Eastern Standard Time, 4 April 1947, and then publicly opened, for furnishing all plant, labor, materials and equipment, and performing all work for the above-described project in strict accordance with the specifications, schedules, drawings and addenda. The work to be done has been divided into Schedules A and B as set forth in the Bid Form. Bids will be accepted for one or both schedules, but no bid will be considered for less than the whole of a schedule.
2. Bids will be submitted in sealed envelopes upon the attached Government form of bid, and marked in the upper left hand corner "Bid under Serial No. 19-016-47-27 to be opened 4 April 1947", the serial number indicating the project for which the bid is submitted. The bidder who is awarded the contract will be required to execute the War Department contract for construction (W. D. Contract Form No. 2). This form is available at the office of the Division Engineer, 31 St. James Avenue, Boston 16, Massachusetts.
3. The right is reserved, as the interest of the Government may require, to reject any and all bids, to waive any informality in bids received, and to accept or reject any or all items of any bid, unless the bidder qualifies such bid by specific limitation.
4. Bid bond on U. S. Standard Form No. 24 in a penal sum of not less than twenty (20) per cent of the bid price will be required with each bid if the bid price is in excess of \$2000.
5. Bidders should carefully examine the drawings and specifications, visit the site of the work, and fully inform themselves as to all conditions and matters which can in any way affect the work or the cost thereof. Should a bidder find discrepancies in, or omissions from, the drawings, specifications or other documents, or should he be in doubt as to their meaning, he should at once notify the Contracting Officer and obtain clarification prior to submitting any bid.

6. Each bidder shall inclose with his bid a statement of whether he is now or ever has been engaged in any work similar to that covered by the specifications herein, the year in which such work was performed and the manner of its execution, and giving such other information as will tend to show the bidder's ability to prosecute the required work.

7. The bidder shall state in his bid that he has available or under his control plant of the character and in the amount required to complete the proposed work within the specified time. Each bidder shall furnish a list of the plant proposed for use on the work.

8. Drawings will be furnished bona fide bidders on request. A deposit of \$10.00 per set will be required to insure their return. The deposit should be in the form of a United States money order or a certified check made payable to "The Disbursing Officer, New England Division, Corps of Engineers, Boston, Mass". The deposit, if made, will be refunded if the drawings are returned in good condition, transportation prepaid, to the issuing office within fifteen (15) days after the opening of bids.

9. Modifications prior to date set for opening bids. - The right is reserved, as the interest of the Government may require, to revise or amend the specifications and/or drawings prior to the date set for opening bids. Such revisions and amendments, if any, will be announced by an addendum or addenda to this Invitation for Bids. Copies of such addenda as may be issued will be furnished to all prospective bidders. If the revisions and amendments are of a nature which requires material change in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as in the opinion of the Division Engineer will enable bidders to revise their bids. In such case, the addendum will include an announcement of the new date for opening bids.

FOR THE DIVISION ENGINEER:

*K. M. Pattee*

K. M. PATTEE  
Lt. Col., Corps of Engineers  
Executive Officer

STATEMENT OF WORK  
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SPECIFICATIONS

PART I

STATEMENT OF WORK

SW-1. DESCRIPTION OF WORK. - a. Work to be done. - The work consists of furnishing all plant, labor, materials and equipment, and performing all work in strict accordance with these specifications and schedules and drawings forming parts thereof for CONSTRUCTION OF WEST SPRINGFIELD DIKE - FOUNDATION TREATMENT, STATION 56+87 TO AGAWAM BRIDGE, WESTFIELD RIVER, MASSACHUSETTS.

b. Location. - The site of the work is on the north bank of the Westfield River, in the southerly part of the Town of West Springfield, Massachusetts.

c. Appropriation. - 21X3113 - FLOOD CONTROL, GENERAL.

d. Authority. - The work provided for herein is authorized by the Flood Control Act of 28 June 1938 (Public No. 761, 75th Congress, 3rd Session) as modified by the Flood Control Act of 18 August 1941 (Public No. 228, 77th Congress, 1st Session) and the Flood Control Act of 22 December 1944 (Public No. 534, 78th Congress, 2nd Session).

SW-2. PRINCIPAL FEATURES. - The work to be performed includes the following principal features:

a. Excavate two 300-foot sections of trench on the river side of the existing dike and construct therein a steel sheet-pile cut-off wall;

b. Construct a toe drainage system on the land side of the dike, complete with a specially prepared drainage trench approximately 5,810 feet in length, concrete headwalls, relief wells, manholes, etc.

The above general outline of principal features does not in any way limit the responsibility of the Contractor to perform all work and furnish all plant, labor, materials and equipment required by the specifications and the plans and drawings referred to therein.

GENERAL CONDITIONS  
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## PART II

### GENERAL CONDITIONS

GC-1. SCOPE OF WORK. - The work to be performed under this contract consists of furnishing all plant, materials, equipment, supplies, labor and transportation, including fuel, power, water (except any materials, equipment, utility or service, if any, specified herein to be furnished by the Government), and performing all work as required by Article 1 of the contract, in strict accordance with the specifications, schedules, and drawings, all of which are made a part hereof, and including such detail drawings as may be furnished by the Contracting Officer from time to time during the prosecution of the work in explanation of said drawings.

GC-2. CHARACTER OF WORK AND MECHANICS. - The work shall be executed in the best and most workmanlike manner by qualified, careful and efficient mechanics in strict accordance with the drawings and specifications.

GC-3. SITE INVESTIGATION AND REPRESENTATIONS. - The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, the conformation and condition of the ground, the character, quality and quantity of surface and subsurface materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this contract. Any failure by the Contractor to acquaint himself with all the available information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work. The Government assumes no responsibility for any understanding or representations made by any of its officers or agents during or prior to the negotiation and execution of this contract, unless (1) such understanding or representations are expressly stated in the contract and (2) the contract expressly provides that responsibility therefor is assumed by the Government. Representations made but not so expressly stated and for which liability is not expressly assumed by the Government in the contract shall be deemed only for the information of the Contractor and the Government will not be liable or responsible therefor.

GC-4. OPERATIONS AND STORAGE AREAS. - a. All operations of the Contractor (including storage of materials) upon Government premises shall be confined to areas authorized or approved by the Contracting Officer. No unauthorized or unwarranted entry upon or passage through, or storage or disposal of materials shall be made upon Government premises. Government premises adjacent to the construction will be made available for use by the Contractor without cost whenever such use will not interfere with other Government uses or purposes. The Contractor shall be liable for any



and all damage caused by him to such Government premises. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature or kind arising from any use, trespass or damage occasioned by his operations on premises of third persons.

b. Temporary buildings (storage sheds, shops, offices, etc.) may be erected by the Contractor only with the approval of the Contracting Officer, and shall be built with labor and materials furnished by the Contractor without expense to the Government. Such temporary buildings and/or utilities shall remain the property of the Contractor, and will be removed by him at his expense upon the completion of the work. With the written consent of the Contracting Officer, such buildings and/or utilities may be abandoned and need not be removed.

c. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways or construct and use such temporary roadways as may be authorized by the Contracting Officer. Where materials are transported in the prosecution of the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any federal, state or local law or regulation. When it is necessary to cross curbs or sidewalks, protection against damage shall be provided by the Contractor and any damaged roads, curbs, or sidewalks shall be repaired by, or at the expense of the Contractor.

GC-5. BASE LINES AND GRADES. - The Contractor shall lay out his work from base lines and grades established by the Government and shall be responsible for all measurements in connection therewith. The Contractor shall, at his own expense, furnish all stakes, templates, platforms, equipment, ranges, and labor that may be required in setting and cutting, or laying out any part of the work. The Contractor will be held responsible for the proper execution of the work to such lines and grades as may be established or indicated by the Contracting Officer and all stakes or other marks thus established shall be preserved by him until their removal is authorized by the Contracting Officer. The Contracting Officer will furnish, on request from the Contractor, all location and limit marks reasonably necessary for the conduct of the work.

GC-6. PROGRESS CHARTS, AND REQUIREMENTS FOR SUNDAY, HOLIDAY AND NIGHT WORK. - a. The Contractor shall within five days or within such time as determined by the Contracting Officer, after date of commencement of work, prepare and submit to the Contracting Officer for approval a practicable schedule, showing the order in which the Contractor proposes to carry on the work, the date on which he will start the several salient features (including procurement of materials, plant and equipment) and the contemplated dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion at any time. The Contractor shall enter on the chart the actual progress at the end of each week or at such intervals as directed by the Contracting Officer, and shall immediately deliver to the Contracting Officer three copies thereof.

b. The Contractor shall furnish sufficient forces, construction plant and equipment, and shall work such hours, including night shifts, overtime operations and Sunday and holiday work, as may be necessary to insure the prosecution of the work in accordance with the approved progress schedule. If, in the opinion of the Contracting Officer, the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve his progress and the Contracting Officer may require him to increase the number of shifts, and/or overtime operations, days of work and/or the amount of construction plant, all without additional cost to the Government.

c. Failure of the Contractor to comply with the requirements of the Contracting Officer under this provision shall be grounds for determination by the Contracting Officer that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part thereof, in accordance with the Delays-Damages Article of the contract.

GC-7. SUBCONTRACTORS. - At the request of the Contracting Officer the Contractor will notify the Contracting Officer in writing of the names of all subcontractors proposed for the work, as well as those subcontractors who have been engaged previously, together with the extent and character of the work to be done by each subcontractor. If, for sufficient reason, at any time during the progress of the work, the Contracting Officer determines that any subcontractor is incompetent or undesirable, he will notify the Contractor accordingly and immediate steps will be taken for cancellation of such subcontract. Subletting by subcontractors shall be subject to the same regulations. Nothing contained in this contract shall create any contractual relation between any subcontractor and the Government.

GC-8. SAMPLES AND DESCRIPTIVE DATA. - a. Any samples and descriptive data required shall:

(1) Be submitted within the time specified in these specifications or, if no time be specified, within a reasonable time before use to permit inspection and testing.

(2) Be shipped prepaid and delivered as specified in these specifications, or as directed by the Contracting Officer.

(3) Be properly marked to show the name of the material, trade name of manufacturer, place of origin, name and location of the work where the material represented by the sample is to be used, and the name of the Contractor submitting the sample.

b. Samples not subjected to destructive tests may be retained until completion of the work but thereafter will be returned to the Contractor, if he so requests in writing, at his own expense. Failure of any sample to pass the specified requirements will be sufficient cause for refusal to consider further any samples from the same manufacturer whose materials failed to pass the tests.

GC-9. PROTECTION OF MATERIAL AND WORK. - The Contractor shall at all times protect and preserve all materials, supplies and equipment of every description (including property which may be Government-furnished or owned) and all work performed. All reasonable requests of the Contracting Officer to inclose or specially protect such property shall be complied with. If, as determined by the Contracting Officer, material, equipment, supplies and work performed are not adequately protected by the Contractor such property may be protected by the Government and the cost thereof may be charged to the Contractor or deducted from any payments due to him.

GC-10. PRESERVATION OF EXISTING VEGETATION. - a. The Contractor will preserve and protect all existing vegetation such as trees, shrubs, and grass on or adjacent to the site which do not unreasonably interfere with the construction as may be determined by the Contracting Officer. The Contractor will be responsible for all unauthorized cutting or damaging of trees and shrubs, including damage due to careless operation of equipment, stock piling of materials or tracking of grass areas by equipment.

b. Care will be taken by the Contractor in felling trees authorized for removal to avoid any unnecessary damage to vegetation that is to remain in place. Any limbs or branches of trees broken during such operations, shall be trimmed with a clean cut and painted with an approved tree pruning compound if required by the Contracting Officer. The Contractor will be liable for or may be required to replace or restore at his own expense all vegetation not protected and preserved as required herein that may be destroyed or damaged.

GC-11. POSSESSION PRIOR TO COMPLETION. - The Government shall have the right to take possession of or use any completed or partially completed part of the work. Such possession or use shall not be deemed an acceptance of any work not completed in accordance with the contract. If such prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment in the contract price and/or the time of completion will be made and the contract shall be modified in writing accordingly.

GC-12. SUSPENSION OF WORK. - The Contracting Officer may order the Contractor to suspend all or any part of the work for such period of time as may be determined by him to be necessary or desirable for the convenience of the Government. Unless such suspension unreasonably delays the progress of the work and causes additional expense or loss to the Contractor, no increase in contract price will be allowed. In the case of suspension of all or any part of the work for an unreasonable length of time causing additional expense or loss, not due to the fault or negligence of the Contractor, the Contracting Officer shall make an equitable adjustment in the contract price and modify the contract accordingly. An equitable extension of time for the completion of the work in the event of any such suspension will be allowed the Contractor, provided, however, that the suspension was not due to the fault or negligence of the Contractor.

GC-13. ACCIDENT PREVENTION, FIRE PREVENTION, AND SANITATION. - The handbook, "Safety Requirements", approved by the Chief of Engineers

16 December 1941, as revised 1 January 1946, (copy of which is on file in the office of the authorized representative of the Contracting Officer on the project) and as may be amended, will govern in the prosecution of the work in accordance with the Accident Prevention Article of the contract.

GC-14. LABOR REPORTS. - As required by the Department of Labor, the Contractor shall promptly furnish, and shall cause any subcontractors to furnish in like manner, within seven days after the regular payment date of each weekly payroll, to the Contracting Officer, a copy of such payroll together with a sworn affidavit with respect to the wages paid each of the employees (which shall not be deemed to apply to persons in classifications higher than laborer and mechanic and those who are the immediate supervisors of such employees) engaged on the work. In addition the Contractor shall furnish, and cause any subcontractors to furnish in like manner, an additional copy of the payroll together with the sworn affidavit as indicated herein for the weekly payroll period ending nearest January 15, April 15, July 15, and October 15. The Contractor shall also prepare and furnish such other labor reports as may be required by the Department of Labor.

GC-15. PREFERENCE FOR DOMESTIC ARTICLES. - Because the materials listed below, or the materials from which they are manufactured, are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin:

Asbestos	Nickel
Chromium	Oil, China wood (Tung oil)
Clay, English ball	Platinum
Clay, English china	Rubber
Copper, natural - nickel alloy	Silk
Cork	Sisal
Jute	Tin
Kaurigum	Wood, Balsa
Lao	Wood, Teak

Articles, materials, or supplies manufactured in the United States and containing mercury, antimony, tungsten, or mica of foreign origin may be used (subject to the requirements of the specifications) in the work herein specified because such manufactured articles, materials, or supplies have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States.

GC-16. CLEANING UP. - The Contractor shall at all times keep the construction area, including storage areas used by him, free from accumulations of waste material or rubbish and prior to completion of the work remove any rubbish from and about the premises and all tools, scaffolding, equipment and materials not the property of the Government. Upon completion of the construction the Contractor shall leave the work and premises in a condition satisfactory to the Contracting Officer.

SPECIAL CONDITIONS  
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# PART III

## SPECIAL CONDITIONS

SC-1. COMMENCEMENT, PROSECUTION AND COMPLETION. - The Contractor will be required to commence work under this contract within fifteen (15) calendar days after the date of receipt by him of notice to proceed, to prosecute said work with faithfulness and energy, and to complete the entire work ready for use not later than one hundred and eighty (180) calendar days after the date of receipt by him of notice to proceed. The time stated for completion shall include final clean-up of the premises.

SC-2. ESTIMATED QUANTITIES. - The quantities listed below are estimates only. Within the limit of available funds the Contractor will be required to complete the work specified herein in accordance with the contract and at the contract price or prices whether it involves quantities greater or less than the following estimates:

### SCHEDULE A

<u>Item No.</u>	<u>Estimated Quantities</u>	<u>Unit</u>	<u>Description of Item</u>
1	-	job	Clearing the Site
2	4,100	sq.yd.	Stripping
3	600	sq.yd.	Removal and Replacement of Existing Riprap and Gravel Bedding
4	12,000	cu.yd.	Common Excavation - General
5	1,700	cu.yd.	Common Excavation - Cut-off Trench
6	800	cu.yd.	Common Excavation - Impervious Borrow
7	19,400	sq.ft.	Steel Sheet Piling
8	1,700	cu.yd.	Impervious Fill
9	30	cu.yd.	Gravel Bedding
10	3,400	cu.yd.	Screened Gravel
11	5,800	cu.yd.	Backfill - Compacted
12	3,900	cu.yd.	Backfill - Semi-Compacted
13	60	cu.yd.	Riprap - Hand-placed
14	20	sq.yd.	Riprap - Grouted
15	4,000	lin.ft.	Vitrified Clay Pipe: 12-inch Extra-Strength (Perforated)
16	600	lin.ft.	Vitrified Clay Pipe: 15-inch Extra-Strength (Perforated)
17	400	lin.ft.	Vitrified Clay Pipe: 18-inch Extra-Strength (Perforated)
18	400	lin.ft.	Vitrified Clay Pipe: 21-inch Extra-Strength (Perforated)
19	400	lin.ft.	Vitrified Clay Pipe: 24-inch Extra-Strength (Perforated)
20	50	lin.ft.	Reinforced Concrete Pipe, 18-inch
21	1,000	lin.ft.	Reinforced Concrete Pipe, 30-inch
22	2,500	lin.ft.	Reinforced Concrete Pipe, 36-inch
23	370	bbl.	Portland Cement
24	270	cu.yd.	Concrete
25	9,500	lb.	Steel Reinforcement

Item No.	Estimated Quantities	Unit	Description of Item
26	18,000	lb.	Miscellaneous Iron
27	112	each	Foundation Relief Wells, Complete, Total Depth 18 feet
28	1,640	lin.ft.	Foundation Relief Wells, Additional Depth
29	-	job	Broach and Repair Cast Iron Pipes
30	1,700	cu.yd.	Topsoil
31	2.0	acre	Fertilizing and Seeding
32	12	each	Piezometers
33	-	job	Fence

#### SCHEDULE B

1	-	job	Clearing the Site
2	4,100	sq.yd.	Stripping
3	Deleted		
4	12,000	cu.yd.	Common Excavation - General
5	Deleted		
6	Deleted		
7	Deleted		
8	Deleted		
9	30	cu.yd.	Gravel Bedding
10	3,400	cu.yd.	Screened Gravel
11	5,800	cu.yd.	Backfill - Compacted
12	3,900	cu.yd.	Backfill - Semi-Compacted
13	Deleted		
14	20	sq.yd.	Riprap - Grouted
15	4,000	lin.ft.	Vitrified Clay Pipe: 12-inch Extra-Strength (Perforated)
16	600	lin.ft.	Vitrified Clay Pipe: 15-inch Extra-Strength (Perforated)
17	400	lin.ft.	Vitrified Clay Pipe: 18-inch Extra-Strength (Perforated)
18	400	lin.ft.	Vitrified Clay Pipe: 21-inch Extra-Strength (Perforated)
19	400	lin.ft.	Vitrified Clay Pipe: 24-inch Extra-Strength (Perforated)
20	50	lin.ft.	Reinforced Concrete Pipe, 18-inch
21	1,000	lin.ft.	Reinforced Concrete Pipe, 30-inch
22	2,500	lin.ft.	Reinforced Concrete Pipe, 36-inch
23	370	bbl.	Portland Cement
24	270	cu.yd.	Concrete
25	9,500	lb.	Steel Reinforcement
26	18,000	lb.	Miscellaneous Iron
27	112	each	Foundation Relief Wells, Complete, Total Depth 18 feet
28	1,640	lin.ft.	Foundation Relief Wells, Additional Depth
29	Deleted		
30	1,700	cu.yd.	Topsoil
31	2.0	acre	Fertilizing and Seeding
32	12	each	Piezometers
33	-	job	Fence

SC-3. PAYMENTS. - Payments will be made as provided in Article 16 of the contract. Unless otherwise authorized in writing by the Contracting Officer, the items of work for which payment will be made shall be limited to those listed and enumerated in the contract. The unit prices or lump sum price or prices stated in the contract will be used in determining the amount to be paid and shall constitute full and final compensation for all the work.

SC-4. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS. - a. Ten (10) sets of contract drawings, maps and specifications will be furnished the Contractor without charge. Additional sets will be furnished on request at the cost of reproduction.

b. The work shall conform to the following contract drawings and maps, all of which form a part of these specifications and are available in the Corps of Engineers Office, 31 St. James Avenue, Boston 16, Massachusetts.

#### LIST OF DRAWINGS

<u>Sheet No.</u>	<u>Title</u>	<u>File No.</u>
1.	Project Location and Index	CT-4-3268
2.	Hydrograph No. 1 - Connecticut River	CT-3-1238
3.	Hydrograph No. 2 - Connecticut River	CT-3-1239
4.	Hydrograph No. 3 - Connecticut River	CT-3-1240
5.	Subsurface Explorations	CT-2-1397
6.	General Plan and Profile	CT-4-3269
7.	Toe-Drain Layout No. 1	CT-4-3935
8.	Toe-Drain Layout No. 2	CT-4-3936
9.	Typical Cross Sections No. 1	CT-4-3274
10.	Typical Cross Sections No. 2	CT-4-3275
11.	Details of Trenches and Headwall	CT-4-3276
12.	Manhole Details No. 1	CT-4-3277
13.	Manhole Details No. 2	CT-4-3937
14.	Details at Circuit Avenue Pumping Station	CT-4-3278
15.	Miscellaneous Details	CT-4-3398

SC-5. SHOP DRAWINGS. - The Contractor shall submit to the Contracting Officer for approval four (4) copies of all shop drawings as called for under the various headings of these specifications. These drawings shall be complete and shall contain all required detailed information. If approved by the Contracting Officer, each copy of the drawings will be identified as having received such approval by being so stamped and dated. The Contractor shall make any corrections required by the Contracting Officer. Three (3) sets of all shop drawings will be retained by the Contracting Officer and one set will be returned to the Contractor. The approval of the drawings by the Contracting Officer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval of such drawings will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor shall be responsible for the dimensions and design of adequate connections, details and satisfactory construction of all work.



SC-6. PHYSICAL DATA. - The information and data furnished or referred to below are not intended as representations or warranties but are furnished for information only. It is expressly understood that the Government will not be responsible for the accuracy thereof or for any deduction, interpretation, or conclusion drawn therefrom by the Contractor.

a. Subsurface investigation. - Borings have been made at the site and in the vicinity of the proposed work and laboratory analyses have been made of the samples of materials taken from some of the borings. The boring samples and the results of the studies and analyses pertaining to them, except those for Borrow Area "H", may be examined at the Soils Laboratory, New England Division, Corps of Engineers, War Department, Watertown Arsenal, Building 39, Watertown, Massachusetts. Samples from borings and test pits at Borrow Area "H" are stored in the basement of the Chemical Paper Manufacturing Co., 642 Main Street, Holyoke, Mass., and may be examined between the dates of 10 March and 31 March 1947, inclusive.

b. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 16 degrees to plus 104 degrees Fahrenheit. The mean annual precipitation at West Springfield is 43.77 inches. The mean monthly precipitation varies from a low of 3.25 inches in April to a high of 4.27 inches in August.

c. Transportation Facilities. - (1) Railroads. - The Boston and Albany Railroad serves the Town of West Springfield with main-line traffic. The Contractor shall investigate the availability of the sidings from the railroad company and make all arrangements with the latter for the use of any sidings for the delivery of any materials and equipment to be used on the work.

(2) Highways. - First-class highways also serve the town. The Contractor shall provide for his own construction or access roads and their maintenance. He shall make his own investigation of available roads for transportation, of load limits for bridges and roads, and other road conditions affecting the transportation of materials and equipment to the site of the work.

SC-7. DATUM AND BENCH MARKS. - The plane of reference of mean sea level datum as used in these specifications is that determined by the following bench mark:

a. Location and Description. - At West Springfield, Hampden County, at B. & A. R.R. Bridge #111 (98.79); on the top of the southwest corner of the south granite wing wall of the west abutment; 16.6 feet south of the center line of the eastbound track; 2.75 feet lower than the top of the rail, and 24.75 feet west of the face of back wall of west concrete abutment. A chiseled square. (First order adjusted). 1933.

b. Elevation. - (M.S.L.) 68.799 feet.

c. Identification. - All (PWD U.S.C. & G.S.)

SC-8. BONDS. - a. Payment bond. - If the contract price exceeds \$2,000.00, the Contractor agrees to furnish a payment bond with good and sufficient surety or sureties acceptable to the Government for the protection of persons furnishing material or labor in connection with the performance of the work under this agreement on U. S. Standard Form No. 25-A or U. S. Standard Form No. 25-C. The penal sum of such payment bond will be as follows: (1) When the contract price is \$1,000,000 or less, 50% of the contract price; (2) When the contract price is in excess of \$1,000,000 and less than \$5,000,000, 40% of the contract price; (3) When the contract price is \$5,000,000 or more, \$2,500,000.00.

b. Performance bond. - If the contract price exceeds \$2,000.00, the Contractor further agrees to furnish a performance bond with good and sufficient surety or sureties acceptable to the Government in connection with the performance of the work under this agreement on U. S. Standard Form No. 25 or U. S. Standard Form No. 25-B. The penal sum of such performance bond will be 50 per cent of the contract price.

c. Any bonds required hereunder will be dated as of the same date as the contract and shall be furnished by the Contractor to the Government at the time the contract is executed.

SC-9. PATENT INDEMNITY. - The Contractor agrees to indemnify the Government, its officers, agents, servants and employees, against liability including costs and expenses for infringement upon any Letters Patent of the United States (except Letters Patent issued upon an application which is now or may hereafter be ordered to be kept secret under the provisions of the Act of October 6, 1917, as amended, 35 U.S.C. 42) occurring in the performance of this contract or arising (in respect only of inventions which are actually embodied in items manufactured or supplied hereunder, or are involved in the use, unless there be more than one practicable use, of such items) by reason of the use or disposal of such items by or for the account of the Government.

SC-10. RATES OF WAGES. - a. The minimum wages to be paid laborers and mechanics on this project, as determined by the Secretary of Labor to be prevailing for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the pertinent locality, are as set forth below.

b. Any class of laborers and mechanics not listed below, employed on this contract, shall be classified or reclassified conformably to the schedule set out below by mutual agreement between the Contractor and class of labor concerned, subject to the prior approval of the Contracting Officer. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question, accompanied by the recommendation of the Contracting Officer, shall be referred to the Secretary of Labor for final determination.

<u>Classification of Laborers and Mechanics</u>	<u>Minimum Rates of Wages Per Hour</u>
Air tool op. (jackhammermen, vibrator)	\$1.00
Asbestos workers	1.70
Asbestos worker improvers: 1st year	.85
2nd year	1.125
3rd year	1.375
Asphalt rakers	1.00
Blacksmiths	1.375
Blacksmith helpers	1.00
Boilermakers	1.75
Boilermaker helpers	1.55
Boilermakers (tank construction)	1.75
Boilermaker helpers (tank construction)	1.50
Carpenters, journeymen	1.625
Cement finishers	1.925
Electricians	1.75
Electrician apprentices:	
1st year	.45
2nd year	.55
3rd year	.70
4th year	.90
Elevator constructors	1.84
Elevator constructor helpers	1.29
Firemen	1.40
Glaziers	1.75
Iron workers, structural	1.85
Iron workers, reinforcing	1.85
Iron workers, ornamental	1.85
Laborers, building	1.00
Laborers, concrete	1.00
Laborers, unskilled	1.00
Lathers	1.75
Marble setters	1.925
Marble setter helpers	1.375
Mason tenders	1.25
Mortar mixers	1.25
Oilers	1.05
Painters, brush	1.625
Piledrivermen	1.75
Pipe layers (concrete and clay)	1.00
Plasterers	1.925
Plasterer tenders	1.25
Plumbers	1.75
Bricklayers	1.925
Power equipment operators:	
Air compressors, up to and including 220 cu.ft.	1.15
Air compressors, 315 cu.ft. and over	1.40
Blade graders	1.50
Bulldozers	1.50
Cranes, derricks, draglines	1.90
Hoists, (1 and 2 drums)	1.50
Hoists, (3 or more drums)	1.90

Classification of Laborers  
and Mechanics

Minimum Rates of Wages  
Per Hour

Power equipment operators: (cont)		
Small mixer		1.05
Road paving mixers and mixing plants		1.70
Motor graders		1.50
Piledrivers		1.90
Pumps and boilers		1.50
Scraper and Tournepull operators		1.65
Rollers		1.40
Shovels		1.90
Caterpillar mounted truck loaders		1.40
Trenching machines		1.90
Master mechanics		1.90
Maintenance mechanics		1.40
Riggers - receive rate prescribed for craft performing operation to which rigging is incidental		
Roofers, composition		1.625
Roofers, slate and tile		1.625
Sheet metal workers		1.75
Sheet metal worker apprentices:		
1st 6 months	35% of journeymen's rate	
2nd " "	40% " "	
3rd " "	45% " "	
4th " "	50% " "	
5th " "	55% " "	
6th " "	60% " "	
7th " "	70% " "	
8th " "	80% " "	
Soft floor layers (linoleum)		1.625
Steam fitters		1.70
Sprinkler fitters		1.75
Sprinkler fitter helpers		1.10
Stone masons		1.925
Terrazzo workers		1.925
Terrazzo worker helpers		1.375
Tile setters		1.925
Tile setter helpers		1.375
Truck drivers: 2-axle		.75
Truck Drivers: 3-axle		.85
Welders - receive rate prescribed for craft performing operation to which welding is incidental		
Wreckers		1.00

SC-11. WATER. - The responsibility shall be upon the Contractor to provide and maintain at his own expense an adequate supply of water of a quantity suitable for his use for construction and domestic consumption. At his own expense he shall install and maintain any necessary water supply connections and piping but only at such locations and in such workmanlike manner as may be authorized by the Contracting Officer. All water shall be carefully conserved. Before final acceptance, temporary connections and piping installed by the Contractor shall be re-

moved in a workmanlike manner to the satisfaction of the Contracting Officer.

SC-12. ELECTRICITY. - All electric current required by the Contractor shall be furnished at his own expense. All temporary connections for electricity shall be subject to the approval of the Contracting Officer. All temporary lines shall be furnished, installed, connected, and maintained by the Contractor in a workmanlike manner satisfactory to the Contracting Officer and shall be removed by the Contractor in like manner at his expense prior to completion of the construction.

SC-13. PLANT. - The Contractor agrees to keep on the job sufficient plant to meet the requirements of the work. Plant shall be kept at all times in condition for efficient work, and subject to the inspection of the Contracting Officer. No reduction in the capacity of the plant employed on the work shall be made except by written permission of the Contracting Officer. The measure of the "capacity of the plant" shall be its actual performance on the work to which these specifications apply.

SC-14. INSPECTION. - a. The work will be conducted under the general direction of the Contracting Officer and is subject to inspection by his appointed inspectors to insure strict compliance with the terms of the contract. The inspectors will direct the maintenance of the gages, ranges, location marks and limit marks in proper order and position. No inspector is authorized to change any provision of the specifications without written authorization of the Contracting Officer, nor shall the presence or absence of an inspector relieve the Contractor from any requirements of the contract.

b. The Contractor shall construct and complete not later than fifteen (15) <sup>calendar</sup> days after the date of receipt by him of notice to proceed, a one-room field office for the use of Government inspectors, to be located near the existing dike at the head of Circuit Avenue. The building shall be of a portable type, consisting of panels assembled by bolts, approximately 12 x 24 feet in size, suitably designed in accordance with the following general description:

(1) Roof of shed type, in 6-foot sections approximately 14 feet in length, to provide one foot overhang on each eave, constructed of 2 x 4-inch rafters on 24-inch centers with one inch roofing boards and 90-pound roll roofing; one roof panel to be fitted with smoke stack suitably located; sidewall panels shall be approximately 6 feet wide to provide 8-foot head room at front and  $6\frac{1}{2}$ -foot head room at rear of building, lined with suitable insulating board, with one entrance door in front of building and two windows on each elevation; sidewall studs to be approximately 24 inches on centers; floor panels to be approximately 6 feet x 12 feet, of tongue and groove material on 2-inch by 6-inch joists spaced on approximately 18 inch centers.

(2) The Contractor shall provide necessary lighting, electric, in the form of approximately four drops and four convenience outlets, and a suitable oil-fired heating stove. The facilities are to be

provided and maintained by the Contractor at no additional expense to the Government, including necessary power and fuel. In addition, the Contractor shall provide sanitary facilities in the form of a suitable privy or water closet acceptable to local sanitary authorities. On completion of the work, the building and appurtenances, excluding the heating stove and privy shall be left at the site and will become the property of the Government.

SC-15. PROTECTION OF EXISTING STRUCTURES, UTILITIES AND WORK. - The Contractor shall protect all existing structures, utilities and work of any kind against damage or interruption of service. Damage or interruption of service resulting from failure so to do shall be repaired or restored promptly by or at the expense of the Contractor.

SC-16. DAMAGE TO WORK. - The Contractor shall be responsible for all work until completion and final acceptance thereof. However, if, in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, additional payment for the repair of such damaged permanent work as ordered by the Contracting Officer will be made at the applicable contract unit or lump sum prices as fixed and established in the contract, which shall be full compensation therefor. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to a part of such work, an equitable adjustment pursuant to Article 3 - Changes of the contract will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work, (including temporary construction) utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

SC-17. LIQUIDATED DAMAGES. - In case of failure on the part of the Contractor to complete the work within the time fixed in the contract or any extensions thereof, the Contractor shall pay the Government as liquidated damages the sum of one hundred dollars (\$100.00) for each calendar day of delay until the work is completed or accepted.

SC-18. FINAL EXAMINATION AND ACCEPTANCE. - As soon as practicable after the completion of the entire work or any divisible part thereof as may be designated in these specifications, a thorough examination thereof will be made by the Contracting Officer at the site of the work. If such work is found to comply fully with the requirements of the contract, it will be accepted, and final payment thereof will be made in accordance with Article 16 of the contract.

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## PART IV

### TECHNICAL PROVISIONS

#### SECTION I. CLEARING THE SITE (Item 1)

TP1-1. WORK INCLUDED. - The Contractor shall perform clearing and grubbing, as herein specified, of the areas within the limits of construction, and shall dispose of spoil material from clearing and grubbing operations in approved disposal areas.

TP1-2. CLEARING. - Clearing shall include the removal of trees, down timber, snags, brush, rubbish, all other objectionable material and other vegetation, except leaves, grass and weeds. Clearing shall be done in the areas near the landside and riverside toes of the existing dike where excavation will be carried out under subsequent items, as indicated on the drawings, and in the area north of the existing berm between Stations 66 + 50 and 79 + 50, upon which spoil fill is subsequently to be placed under Item 12.

TP1-3. GRUBBING. - Grubbing shall include the removal of stumps, roots, buried logs and other objectionable matter from areas previously cleared as may be directed by the Contracting Officer. Tap roots and other projections over 1-1/2 inches in diameter within the limits of structure foundations shall be grubbed out to a depth at least 3 feet below the ground surface, unless otherwise directed by the Contracting Officer.

TP1-4. DISPOSAL OF MATERIALS. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas to be provided by the Contractor. No material shall be thrown into, or left along the bank of the river. The disposal of materials shall closely follow the operations of clearing and grubbing so that brush and other debris will not be washed into the river in case of high water. At no time shall material be placed on land adjacent to the construction area.

TP1-5. PAYMENT. - Payment for all work in connection with clearing the site as above specified, including the clearing, grubbing, loading, hauling, and disposal of the materials, will be made at the contract price for Item 1, "Clearing the Site".

## PART IV

### SECTION II. EXCAVATION (Items 2 to 6, incl.)

TP2-1. GENERAL PROVISIONS. - a. Scope of work. - The excavation shall conform to the lines and grades shown on the drawings. The right is reserved to modify any part of the work if, in the opinion of the Contracting Officer, conditions require such modification.

b. Disposal of materials. - (1) Material from the excavations, suitable for fill and backfill, shall be used in the permanent construction. No material shall be wasted, unless specifically authorized by the Contracting Officer. If, at the time of excavation, it is not possible to place the material in the proper section of the permanent construction, it shall be stockpiled in approved areas for later use. Materials from the excavations that are not acceptable for use in the permanent construction shall be wasted in the spoil area as shown on the drawings, or as approved by the Contracting Officer. After completion of all excavation, the spoil area shall be neatly dressed, smoothly graded, sloped for drainage, and left in a slightly condition.

(2) Topsoil obtained from the stripping operation shall be stockpiled in approved locations to be used later in the locations indicated on the drawings, unless otherwise authorized by the Contracting Officer.

c. Measurement and payment. - A survey of the site area of the specified work will be made just prior to the beginning of the work, and all measurements will be based on this survey, without regard to any changes in the site area that may occur during the prosecution of the work. Measurement for common excavation will be made between the grade and slope lines indicated on the drawings or staked in the field and the ground surface as indicated by the above-mentioned survey. The slope lines, as shown on the drawings, indicate only the lines to which excavation and fill will be measured and paid for under this contract and are not intended to, and do not represent the actual slope to which the excavation must be made to safely perform the work. The actual slopes may be greater or less than those indicated, depending on the materials excavated and methods used in performing the work, but such changes will not change the measurement for payment from the original lines as specified above and as indicated on the drawings or staked in the field. The Contractor will be required to backfill any excess excavation with approved material, or with additional concrete where excess excavations are adjacent to concrete structures, at no additional expense to the Government.

d. Shoring. - Where approved by the Contracting Officer, shoring may be used in lieu of excavation to the slope or pay lines shown on the drawings. The Contractor shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while making structure excavations. If shoring is necessary and the Contractor does not use it, its use will be ordered by the Contracting Officer.

Shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford ready inspection and ample clearance for the permanent work. Shoring shall be removed upon completion of the permanent work or as soon as the construction does not require its use. No additional payment will be made for the timber sheeting or shoring used in lieu of excavation. The cost of such material is to be included in the contract price for the excavation.

e. Temporary drains. - Such temporary drains and ditches as may be required shall be constructed by the Contractor at no additional expense to the Government.

TP2-2. CLASSIFICATION. - All materials excavated will be classified as follows:

a. Common excavation shall include all excavation, not otherwise classified, required to complete the work shown on the drawings or directed by the Contracting Officer.

b. Detailed classification is as follows:

- (1) Stripping (Item 2)(see Paragraph TP2-3).
- (2) Removal and Replacement of Existing Riprap and Gravel Bedding (Item 3)(see Paragraph TP2-4).
- (3) Common Excavation (see Paragraphs TP2-5, TP2-6 and TP2-7).

General (Item 4)  
Cut-off Trench (Item 5)  
Impervious Borrow (Item 6)

TP2-3. STRIPPING (Item 2). - a. Work included. - The Contractor shall strip the landside and riverside toes of the existing dike areas indicated on the drawings where excavation will be carried out under subsequent items, as approved by the Contracting Officer. Borrow areas are not included.

b. Disposal of materials. - Topsoil shall be disposed of as provided in Paragraph TP2-1b.

c. Measurement and payment. - Measurement will be made by the square yard. Payment for all work in connection with stripping, including excavating, loading, hauling, stockpiling, rehandling and disposal will be made at the contract unit price for Item 2, "Stripping".

TP2-4. REMOVAL AND REPLACEMENT OF EXISTING RIPRAP AND GRAVEL BEDDING (Item 3). - a. Work included. - (1) The Contractor shall remove and stockpile all riprap and gravel bedding overlying the trench to be excavated on the river side slope of the existing dike. Care shall be exercised in carrying this type of excavation down not deeper than the line of demarkation between the gravel bedding and the underlying

impervious blanket material. The riprap and gravel bedding so removed shall be stockpiled separately in the vicinity of the work. It is believed that the riprap and gravel bedding were originally placed within reasonable construction tolerances of the lines and grades indicated on the drawings. No additional payment will be allowed under this item for removal of gravel and riprap found to exceed the depth shown on the drawings.

(2) The Contractor shall replace on the surface of the dike a thickness of 6 inches of gravel bedding at the locations from which gravel has been removed under this contract as shown on the drawings or directed by the Contracting Officer. In the event that a sufficient quantity of suitable gravel is not available from salvage, owing to loss or waste attendant on the Contractor's operations, the Contractor shall furnish gravel for the completion of gravel bedding for the specified areas at no additional expense to the Government.

(3) The Contractor shall replace on the surface of the dike a thickness of one foot of riprap at the locations from which riprap has been removed under this contract as shown on the drawings or directed by the Contracting Officer. In the event that a sufficient quantity of suitable stone is not available from salvage, owing to loss or waste attendant on the Contractor's operations, the Contractor shall furnish stone for the completion of riprap for the specified areas at no additional expense to the Government.

b. Materials. - (1) Gravel. - Additional gravel required to complete the work shall conform to the provisions of Paragraph TP5-1b.

(2) Riprap. - Additional riprap required to complete the work shall conform to the provisions of Paragraph TP5-5b.

c. Placing. - (1) Gravel. - The placing of gravel for gravel bedding shall conform to the provisions of Paragraph TP5-1c.

(2) Riprap. - The placing of riprap shall conform to the provisions of Paragraph TP5-5c.

d. Measurement and payment. - Measurement will be made by the square yard of the area, within the limits shown on the drawings or staked in the field, within which riprap and gravel are removed and replaced. Measurements will be taken in the plane of the riprap surface. Payment for all work in connection with the removal and replacement of the riprap and gravel bedding, including excavation, loading, hauling, stockpiling, placing, and making up any deficiency attributable to waste in quantity of gravel and riprap, will be made at the contract unit price for Item 3, "Removal and Replacement of Existing Riprap and Gravel Bedding".

TP2-5. COMMON EXCAVATION - GENERAL (Item 4). - a. Work included. - Common excavation - general includes excavation for the toe-drain, man-holes, outfalls, headwalls, and any other excavation not otherwise classified under other items. The work shall conform to the lines and grades shown on the drawings.

b. Disposal of material. - Common excavation which, in the judgment of the Contracting Officer, is suitable for backfill will be so used. Such common excavation that, in the judgment of the Contracting Officer, is not suitable for backfill shall be wasted in the area set aside for that purpose.

c. Measurement and payment. - Measurement will be made by the cubic yard, measured as specified in Paragraph TP2-1c. Payment for all work in connection with this item shall include Loading, hauling, temporary protection, bulkheads, drains, unwatering, shoring, and such stockpiling and rehandling as may be necessary. Payment will be made at the contract unit price for Item 4, "Common Excavation - General".

TP2-6. COMMON EXCAVATION - CUT-OFF TRENCH (Item 5). - a. Work included. - The Contractor shall excavate and dispose of the materials in the new cut-off trench which is to be located under the toe of the existing dike. The existing dike is provided with a riverside blanket of impervious material, having a minimum thickness of 3 feet, ending in a generally rectangular shaped cut-off of impervious material located approximately under the toe of the dike. The impervious material shall be excavated in a dry condition.

b. Disposal of materials. - (1) Pervious material. - The pervious material from the cut-off trench excavation shall be disposed of as provided in Paragraph TP2-1b.

(2) Impervious material. - The Contractor shall so coordinate excavation operations with the placing of steel sheet piling, backfill of cut-off trench and reconstruction of blanket that the impervious material excavated from the toe and cut-off trench of the existing dike shall be hauled and placed in its final location in a continuous operation to the maximum possible extent. Such material as cannot be handled in this manner shall be stockpiled until such time as final disposal in the new cut-off or blanket reconstruction can be made. Stockpiles shall be so segregated from other materials that a minimum of deterioration in the quality of the impervious material will be encountered. The Contractor may use any approved method of transporting materials in natural dry condition to approved locations.

c. Measurement and payment. - Measurement will be made by the cubic yard measured as specified in Paragraph TP2-1c. Payment will cover all work in connection with this item and shall include loading, hauling and disposal of materials, temporary protection, bulkheads, drains, unwatering and shoring. Payment will be made at the contract unit price for Item 5, "Common Excavation - Cut-off Trench".

TP2-7. COMMON EXCAVATION - IMPERVIOUS BORROW (Item 6). - a. Work included. - Borrow areas shown on the drawings will be furnished by the Government. The Contractor shall excavate in the borrow areas shown on the drawings or other approved areas any additional impervious material required to be used in the cut-off trench. The impervious material shall be excavated in a dry condition and may be hauled by any approved

method of transporting materials in natural dry condition to approved locations. Borrow excavation shall include the stripping of the areas and disposal of objectionable topsoil containing roots or other debris, the removal and the disposal of any other objectionable material designated by the Contracting Officer, and the transportation of the material to the point of disposal. To provide suitable fill materials, excavation shall be made to the depths and in the locations approved by the Contracting Officer. During and after excavation, the borrow areas shall be graded so that all surface water will drain readily from them. The borrow areas shall be graded so that the slopes blend into the surrounding topography, shall be dressed smoothly and evenly, and shall be left in a neat condition satisfactory to the Contracting Officer.

b. Measurement and payment. - (1) Measurement will be made by the cubic yard, measured as specified in Paragraph TP2-1c, and will include the material excavated from the borrow area which is not acceptable for impervious borrow. Payment will cover all work in connection with this item and shall include loading, hauling and disposal of materials, temporary protection, bulkheads, drains, unwatering and shoring. Payment will be made at the contract unit price for Item 6, "Common Excavation - Impervious Borrow".

(2) No payment will be made for material excavated from the borrow area and used in backfilling unauthorized excavations. A representative deduction from the borrow quantity will be made for material excavated from the borrow area and placed in the work outside the payment lines for Item 8, on the basis of 100 cubic yards of placed material equalling 115 cubic yards of undisturbed material in the borrow area.

PART IV

SECTION III. STEEL SHEET PILING (Item 7)

TP3-1. WORK INCLUDED. - The Contractor shall construct the steel sheet piling cut-off under the earth dike as shown on the drawings and in accordance with these specifications or modifications designated by the Contracting Officer. The cut-off shall be constructed of piles of varying lengths, including specials, driven to grade, between the limits as shown on the drawings or as directed by the Contracting Officer.

TP3-2. TYPE AND PROPERTIES. - The piles shall be of approved commercial type and shall have a minimum thickness of metal of  $3/8$  inch, except that a reasonable reduction for shaping the joints of the interlock will be permitted. The piles shall provide a section modulus of not less than 5.4 inches cubed per linear foot of cut-off, and shall have the standard weight per square foot of cut-off as shown in manufacturers' handbooks exclusive of any welded or riveted connection or reinforcement. The interlocked joints shall develop a strength in direct tension of not less than 8,000 pounds per linear inch of interlock without rupture. The piles shall be continuously interlocked throughout their entire length and shall be provided with standard pulling holes. The type and dimensions of the piles the Contractor proposes to furnish shall be submitted to the Contracting Officer for approval before any piles are delivered to the work.

TP3-3. MATERIALS. - Steel for the sheet piling shall conform to Federal Specification QQ-S-751a for "Steel, Structural (Including Steel for Cold-Flanging) and Steel, Rivet; (for) Ships other than Naval Vessels, Structural Grade", except for the following requirements:

a. Tensile strength shall be not less than 70,000 pounds per square inch, except that fabricated sections such as corner piles, tee piles, and other special sections shall be of steel having a tensile strength of not less than 60,000 pounds per square inch.

b. Elongation in 8 inches, minimum, per cent,  $\frac{1,400,000}{\text{tensile strength}}$ .

TP3-4. DRIVING. - The piles shall be driven to form a continuous interlocking diaphragm down to the elevations established for the bottom of the cut-off, as shown on the drawings. Special care shall be taken to avoid damage to sewers, drains and conduits encountered in the work. A protecting cap shall be used in driving. The hammers shall be of a suitable size and type, either steam- or air-operated. The use of a water jet may be permitted at the discretion of the Contracting Officer. Piles shall be driven without injury to them, as true to line and grade as possible, and shall be cut off, where necessary, to the top elevations of the sheet piling cut-off and trimmed to vertical lines at steps in the foundations as shown on the drawings. Proper precautions shall be taken to prevent rupture at the interlocks. Piles ruptured at the interlock or otherwise injured shall be removed and replaced with new piles

by the Contractor at no additional expense to the Government. Special sections, such as wedges, shall be installed where required to correct the alignment of the sheet piling.

TP3-5. CONSTRUCTION SEQUENCE. - The Contractor will be permitted to drive steel sheet piling through the partially completed cut-off trench fill following the completion of this fill to an elevation not exceeding 6 inches below the top of the piling in its finished grade position.

TP3-6. MEASUREMENT AND PAYMENT. - a. Measurement will be made by the square foot for the amount of steel sheet piling actually in place, as specified, below the top elevation of the sheet piling cut-off as shown on the drawings or as directed by the Contracting Officer. The area for which payment will be made will be the area of the sheet piling in place, below that elevation, projected to the vertical plane of the driving line shown on the drawings. Payment will be made at the contract unit price for Item 7, "Steel Sheet Piling".

b. Partial payments up to 50 per cent of the contract price will be made when the steel sheet piling for Item 7 is delivered to the site of the work, provided the quality of such material is satisfactory to the Contracting Officer, but in no case will the payment to the Contractor exceed the cost of the material delivered to the site of the work. If any material stored and partly paid for is not kept protected, no further partial payments provided for in this subparagraph will be made.

c. Should it be found impracticable to drive piling to the depths shown on the drawings, the Contractor will be paid for that portion of each pile cut off and removed as directed by the Contracting Officer, at the rate of 2-1/2 cents per pound, computed weight, determined by reference to applicable manufacturers' standard tables; provided, that the length of the cutoff portion of any pile to be paid for shall not exceed the difference between the length specified or directed to be driven below the cut-off elevation and the length actually driven below that grade. Cutoffs shall become the property of the Contractor and shall be removed from the work by the Contractor.



## PART IV

### SECTION IV. IMPERVIOUS FILL (Item 8)

TP4-1. WORK INCLUDED. - The Contractor shall grade and compact the impervious material required for the cut-off trench and the reconstruction of the dike-toe to the elevations, lines, grades and cross sections as shown on the drawings.

TP4-2. MATERIALS. - a. General. - The impervious material shall be obtained from the excavation of the cut-off trench as specified in Paragraph TP2-6 and from borrow areas as specified in Paragraph TP2-7. Suitable material from the cut-off trench shall not be wasted and borrow material shall be used only as a supplement to this source.

b. Test requirements. - The impervious material shall conform to the test requirements and approved classification established by the Soils Laboratory, Corps of Engineers Office, Watertown, Massachusetts. The Contractor shall furnish the necessary labor and facilities for taking test samples which will be removed from the fill by representatives of the Contracting Officer and subjected to field tests or boxed for shipment to the Soils Laboratory. Test samples will be taken at such intervals as will give, in the opinion of the Contracting Officer, a comprehensive knowledge of the material and its placement and compaction in each section of the cut-off.

TP4-3. ROLLED IMPERVIOUS FILL. - a. General. - The cut-off trench and toe of the existing dike shall be filled with impervious materials in the dry as shown on the drawings or as specified. The fill shall be placed in layers, moistened and rolled as specified, whenever in the opinion of the Contracting Officer it is possible to do so.

b. Cut-off trench. - Fill for the cut-off trench shall be placed in the dry. Any water in the trench shall be drained to a sump and removed by approved methods. Under this condition the fill shall be made by working the materials toward the sump and sloping the surface of the fill longitudinally toward the sump. Approved methods shall be used for drying up the foundation. In the performance of the fill operation for the cut-off trench, the Contractor will be permitted to carry the fill to an elevation 6 inches below the top elevation of the steel sheet piling before the piling is driven.

c. Furnishing and placing. - (1) The dumping of the successive loads of material hauled to the site shall be at locations as approved by the Contracting Officer. After dumping, the materials shall be bulldozed or otherwise spread in approximately 6-inch layers after compaction, and rolled. Should the material for the fill be too high in water content when dumped, it shall be bulldozed or otherwise spread and harrowed or stirred and left for a sufficient time to allow the surplus water to dry out before being rolled. If, in the opinion of the Contracting Officer, the rolled surface of any layer of the materials is too smooth to bond properly

with the succeeding layer or, if the materials have dried out sufficiently to cause cracks in the surface, the rolled surface shall be roughened or loosened by a disc harrow, or other approved means, and dampened, if required, before the succeeding layer is placed thereon. All roots, trash, and debris, and stones greater than 6 inches in diameter shall be removed promptly from the fill and disposed of to the satisfaction of the Contracting Officer. Routing of construction equipment on any part of the embankment shall be subject to direction by the Contracting Officer. The surface of each layer of fill for the riverside dike toe reconstruction shall be sloped a maximum of 3 per cent toward the river to insure drainage.

(2) If, after any fill has been placed in the trench or the reconstruction of the toe and before the completion and acceptance of the work, any material becomes lost, loosened or otherwise damaged because of any operation of the Contractor or any causes that in the opinion of the Contracting Officer were avoidable or under the control of the Contractor, such material shall be replaced to the satisfaction of the Contracting Officer and at no additional expense to the Government.

(3) The Contractor shall cease work on the fill at any time when satisfactory work cannot be done on account of rain, high water, cold weather, or other unsatisfactory conditions.

d. Moisture control. - To obtain the desired compaction for the varying kinds of materials used, the moisture content of the material being placed shall be the optimum required for satisfactory compaction as determined by the Contracting Officer. If required, the compacted surface shall be sprinkled with water as directed immediately before placing each new layer. The moisture content shall be sufficient to dampen the filled materials as required, but the amount of sprinkling shall be controlled so that no free water will appear on the surface during or subsequent to the rolling. An adequate supply of water shall be available. Jets shall not be directed at the fill material with such force that the finer materials are washed out.

e. Compaction. - (1) Tamper-type roller. - Rolling for the impervious section of the fill shall be done by a tamper-type roller such as a "sheeps-foot" roller, water- or sand-ballasted, having tamping feet uniformly staggered over its cylindrical surface, and equipped with cleaners, or by other satisfactory type of tamper roller. Each tamping foot shall project approximately 7 inches from the cylindrical surface of the roller and shall have a face area of not less than 5 and not more than 7 square inches. The spacing shall be such as to provide a minimum of two tamping feet for each square foot of cylindrical surface. Addition or reduction in the number of tamping feet shall be made when directed by the Contracting Officer. The total weight of the roller in pounds divided by the total area of the maximum number of tamping feet in one row parallel to the axis of the roller shall be not less than 250 pounds per square inch, tamping foot area with the drum

empty, and not less than 450 pounds per square inch, tamping foot area, with the drum ballasted. The design and operation of the tamping roller shall be subject to the approval of the Contracting Officer.

(2) Rolling. - When the moisture content and condition of the spread impervious layers of the fill are satisfactory to the Contracting Officer, the Contractor shall roll the impervious layers with tamper type rollers. Each roller shall be pulled by a crawler type tractor of suitable power, at a speed of approximately 2-1/2 miles per hour. Each square foot of each layer of the fill material shall be compacted by not less than six passes of the rollers. Additional passes of the rollers shall be made if necessary to obtain the compaction desired by the Contracting Officer. Successive trips of rollers shall overlap by at least 2 feet. Failure to comply with this requirement for careful rolling will be a cause for additional trips by the Contractor at no additional expense to the Government. Where new material abuts old material, either in place or in embankment, the old material shall be cut or broken by machine, or approved hand scarifying methods, until it shows the characteristic colors of undried materials, and the rollers shall work on both materials, bonding them together. Portions of the fill which the roller cannot reach for any reason shall be thoroughly compacted in 4-inch layers by tamping with hand or power tampers. The degree of compaction for such portions of the fill shall be equivalent to that obtained by sprinkling and rolling as specified for the other portions of the earth fill.

(3) Special compaction adjacent to piling. - In the event that the Contractor elects to drive the steel sheet piling through the cut-off trench after partial fill has been made, special compaction of the material adjacent to the piling will be required as directed by the Contracting Officer. After the piling has been driven to finished grade, the impervious material adjacent to the piling shall be loosened with a paving breaker, equipped with a spade type bit, moistened, and re-compacted with a paving breaker equipped with a ball-shaped bit.

(4) Tests for compaction. - Samples of all fill materials for testing, both before and after placing and compaction, will be taken at frequent intervals by the Contracting Officer. Corrections, adjustments, modifications of methods, selection of material and moisture content will be made from these tests to secure the maximum density of the materials in the fill.

TP4-4. FROZEN MATERIALS. - No earth shall be placed upon a frozen surface, nor shall frozen earth, snow or ice be placed in the fill. In cases of emergency, the Contracting Officer may require frozen material to be stockpiled for later use in the fill.

TP4-5. SHRINKAGE OR SETTLEMENT. - No measurement will be made of additional material placed on account of shrinkage during construction. The cost of placing and compacting such additional material shall be included in the contract price for fill. Measurement for all required fill material excavated and transported to point of placement will be in accordance with Paragraph TP2-7 c.

TP4-6. MEASUREMENT AND PAYMENT. - Measurement will be made by the cubic yard for the amount of material placed as approved by the Contracting Officer, measured in place after compacting to the lines and grades shown on the drawings. Measurement will be based on a survey to be made just prior to the beginning of the placing of the fill. Quantities will be determined from cross sections and profiles obtained from this survey, and will be the volume between the original surface as determined from the survey and the slope lines and grades as indicated on the drawings or as staked in the field by the Contracting Officer. Payment shall include the work of preparing the base, spreading the layers, wetting, rolling or tamping and trimming to line necessary for completing the impervious section of the fill. Payment will be made at the contract unit price for Item 8, "Impervious Fill".

PART IV

SECTION V. GRAVEL, BACKFILL, AND RIPRAP (Items 9 to 14 incl.)

TP5-1. GRAVEL BEDDING (Item 9). - a. Work included. - The Contractor shall place a thickness of 6 inches of gravel required for riprap bedding in new locations to the lines and grades shown on the drawings.

b. Materials. - The material shall consist of clean bank-run gravel, composed of hard, durable particles free from clay lumps and organic material and shall be well graded within the following limits:

<u>Sieve</u>	<u>Total Per Cent Passing by Weight</u>
4 inch square mesh	100
1 inch square mesh	60 - 100
4 meshes per inch	30 - 70
10 meshes per inch	15 - 50
48 meshes per inch	3 - 20
200 meshes per inch	Not over 5

The material shall be furnished from sources approved by the Contracting Officer.

c. Placing. - The materials shall be placed as shown on the drawings or as approved, and with such handplacing as may be necessary to trim to the required slopes. The Contractor will not be required to tamp or roll the material, but if considered necessary by the Contracting Officer, will be required to consolidate it with water so that no settlement or voids will later result. If necessary to avoid segregation, the material shall be moistened before placing.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of gravel bedding measured in place after consolidation to the limits shown on the drawings or as approved by the Contracting Officer. Payment will be made at the contract unit price for Item 9, "Gravel Bedding", which shall include all cost of furnishing, hauling and placing gravel bedding.

TP5-2. SCREENED GRAVEL (Item 10). - a. Work included. - The Contractor shall place screened gravel of specified quality required for vitrified clay pipe drains, as shown on the drawings.

b. Materials. - Screened gravel shall consist of hard durable, clean gravel graded within the following limits:

<u>Sieve</u>	<u>Total Per Cent Passing by Weight</u>
2-inch square mesh	100
1/2-inch square mesh	65 - 90
4 meshes per inch	40 - 65
10 meshes per inch	15 - 40
48 meshes per inch	Not over 5

The material shall be approved by the Contracting Officer before delivery is made to the site of the work. Crushed stone will not be permitted as a substitute.

c. Prevention of segregation. - The Contractor shall take adequate precaution to prevent segregation of the material by moistening the material and keeping it moist to the satisfaction of the Contracting Officer during the operation of loading, hauling in trucks, dumping and placing in the trench.

d. Placing. - The material shall be placed to the lines, grades and sections as shown on the drawings, with such hand-placing as may be necessary to trim to the required slopes. The Contractor will not be required to tamp or roll the material, except as necessary to adequately backfill around pipe, but shall consolidate it with water to the extent directed, for the purpose of avoiding future settlement. Following the completion of the screened gravel fill to the required depth, the Contractor shall cover the entire surface of the gravel in the drain with a single layer of asphalt-saturated felt, Federal Specification HH-F-191a, Type I, weight 15 pounds per square, 36 inches wide, for the purpose of preventing subsequent fill from mixing with the gravel.

e. Measurement and payment. - Measurement will be made by the cubic yard for the amount of screened gravel measured in place after consolidation to the limits shown on the drawings or as approved by the Contracting Officer. The volume of the space occupied by the pipe drains will not be included in computing the quantity of gravel. Payment will be made at the contract unit price for Item 10, "Screened Gravel", which shall include all costs of furnishing, hauling and placing screened gravel and furnishing and placing asphalt saturated felt.

TP5-3. COMPACTED BACKFILL (Item 11). - a. Work included. - The Contractor shall place, grade, and consolidate materials required for backfill of toe-drains, laterals, manholes and headwalls to the lines and grades shown on the drawings.

b. Materials. - Material for backfill shall be free draining and shall be obtained from stockpiles of excavated material or directly from required excavation. Material shall be free from stumps, roots, sod, rubbish or other unsuitable materials or substances.

c. Scarifying. - Where backfill is placed in the landside toe of the dike, the exposed cut face of the dike shall be scarified to provide a bond with the new backfill.

d. Placing. - Backfills shall consist of materials approved for the purpose, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross section. Each layer shall be compacted thoroughly with a crawler-type tractor weighing not less than 40,000 pounds or other approved equipment. A minimum of four passes of the tractor treads on each square foot of backfill area will be required for satisfactory compaction. Portions of the backfill area which the compacting equipment cannot reach for any reason shall be thoroughly compacted by tamping with hand or power tampers in 4-inch layers. The degree of compaction for such portions of the backfill shall be equivalent to that obtained by compacting with tractor equipment.

e. Moisture control. - To obtain the desired compaction for the varying kinds of materials used, the moisture content of the material being placed shall be the optimum required for satisfactory compaction as determined by the Contracting Officer. If required, the compacted surface shall be sprinkled with water as directed immediately before placing each new layer. The moisture content shall be sufficient to dampen the filled materials as required, but the amount of sprinkling shall be controlled so that no free water will appear on the surface during or subsequent to the rolling. An adequate supply of water shall be available. Jets shall not be directed at the embankment material with such force that the finer materials are washed out.

f. Repair of roads and drives. - (1) General. - At locations where the performance of excavation operations has necessitated broaching of existing gravel, cinder and bituminous-treated gravel road surfaces, the Contractor shall replace the road surface removed with an equal type surface.

(2) Bituminous surface treatment. - (a) Bituminous surfaces cut for trench excavation shall be replaced with a suitable bituminous mix conforming to specifications for highways constructed by the State of Massachusetts.

(b) The sub-grade for bituminous surfaces shall be prepared in accordance with good highway engineering practice. Such trenches or other places at which excavation has taken place which has disturbed bituminous surfaces shall be backfilled in accordance with the specifications for filling or backfilling such trenches or excavations. The finished grade of such filling or backfilling shall be at the elevation of the subgrade of the bituminous surface being repaired.

(c) The bituminous surface treatment of the required thickness and layers shall be replaced to match the existing work. The bituminous material shall be spread uniformly and compacted to a smooth even surface with equipment, as approved by the Contracting Officer, to form a finished pavement satisfactorily constructed in accordance with good highway engineering practice.

(3) Cinder surface treatment. - Where cinder surface treatment is required to match the existing construction, the Contractor shall replace with materials satisfactory for the purpose intended or as directed by the Contracting Officer. The use of any required machinery or tools shall be of a type satisfactory for this purpose and the cinders shall be placed over a subgrade which has been finished in accordance with good highway engineering practice. The work shall be constructed to the lines and grades as shown on the drawings or as directed by the Contracting Officer.

(4) Gravel surface treatment. - When a gravel surface treatment is required to match the existing pavement, the Contractor shall construct a gravel surface to the lines and grades as shown on the drawings or as directed by the Contracting Officer, by using approved methods and constructing the work satisfactory for the purpose intended.

(5) Payment. - No separate payment will be made for constructing the bituminous, cinder and gravel surfaces but the payment therefor shall be included in the contract unit price for Item 11.

g. Measurement and payment. - Measurement will be made by the cubic yard for the amount of compacted backfill placed in the completed work to the lines and grades shown on the drawings. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing compacted backfill, including repair of road surfaces, will be made at the contract unit price for Item 11, "Backfill-Compacted".

T5-4. SEMI-COMPACTED BACKFILL (Item 12). -a. Work included. - The Contractor shall place, grade, and consolidate materials made available from spoil to the lines and grades shown on the drawings adjacent to the existing landside berm between Stations 66+50 to 79+50 approximately.

b. Materials. - Materials for backfill shall consist of spoil obtained from required excavations, and may be pervious, impervious or mixture thereof. Any earth materials may be used except that all such materials shall be reasonably free from rubbish, trees and brush.

c. Placing. - The material shall be spread in layers and compacted by even routing of construction equipment. A selection of material will be required for a 2-foot depth of spoil over the toe drain where the Contractor shall place the more pervious materials from those available. Additional compaction of the material as directed by the Contracting Officer will be required within 2 feet of manholes to prevent material from settling away from the structures.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of semi-compacted backfill placed in the completed work within the lines and grades shown on the drawings, and will be based on a survey to be made prior to commencement of work. The quantities will



be determined from cross sections obtained from this survey and will be the volume between the surface as determined from the survey and the slope lines and grades as indicated on the drawings or as staked in the field by the Contracting Officer. Quantities will be measured after compaction. Payment will be made at the contract unit price for Item 12, "Backfill - Semi-Compacted".

TP5-5. RIPRAP - HAND PLACED (Item 13). - a. Work included. -

The Contractor shall place hand-placed riprap on the riverside of the dike to the lines and grades shown on the drawings.

b. Materials. - Riprap shall be of durable rock of acceptable sizes, with a specific gravity of not less than 2.65. New stone supplied shall be reasonably match type, color and quality of existing stone and shall be approved by the Contracting Officer before delivery to the site of the work. Rock for riprap shall be angular and of a uniform shape so as to furnish a reasonably smooth, even surface. Not more than 5 per cent by weight of the rock shall be smaller than one-half cubic foot in volume and at least 75 per cent of the rock used shall be from 1 to 2 cubic feet in volume with one dimension approximately equal to the depth of the riprap course.

c. Placing. - The riprap shall be laid to the lines and grades shown on the drawings. A tolerance of 3 inches above or below the slope line shown on the drawings will be allowed for the finished slope surface of the hand-placed riprap. The rock shall be closely laid on a base of gravel bedding (see Paragraph TP5-1), with the dimension approximately equal to the depth of the riprap course normal to the slope, and with joints broken where possible. The rock shall be roughly squared to minimize voids resulting from abutting undercut faces. The joints on the surface of the riprap shall be filled with tightly driven spalls. Large rock shall be well bedded at the edges of the riprap to prevent undermining.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of hand-placed riprap, measured in place to a thickness of 1 foot, satisfactorily placed in the completed work to the specified lines and grades. Payment will be made at the contract unit price for Item 13, "Riprap - Hand-placed", which shall include all costs of furnishing, hauling, and placing.

TP5-6. RIPRAP - GROUTED (Item 14). - a. Work included. - The Contractor shall place grouted riprap at drain outfalls as indicated on the drawings.

b. Materials. - Riprap shall be durable rock of acceptable sizes, with a specific gravity of not less than 2.65. Rock shall be approved by the Contracting Officer before delivery to the site of the work. Rock for riprap shall be angular and of uniform shape so as to furnish a reasonably smooth, even surface. Not more than 5 per cent by weight of the rock shall be smaller than one-half cubic foot in volume

and at least 75 per cent of the rock used shall be from 1 to 2 cubic feet in volume with one dimension approximately equal to the depth of the riprap course.

c. Placing. - The grouted riprap shall be laid to the lines and grades shown on the drawings. A tolerance of one inch above or below the grade line shown on the drawings will be allowed for the finished grade surface. The rock shall be closely laid on a base of gravel bedding (see Paragraph TP5-1). Grouting shall be done on clean riprap surfaces with a grout mixture of 1 part Portland cement and 2-1/2 parts sand by volume combined with water to a suitable consistency. Cement and sand used in the grout shall conform to the provisions of Paragraphs TP7-4 and TP7-5. The grout shall be worked into the joints of the riprap surface with brooms or other approved means so as to fill the voids completely.

d. Measurement and payment. - Measurement will be made by the square yard for the amount of grouted riprap of the required thickness placed to the specified lines and grades in the completed work. Payment shall include all costs for furnishing, hauling, placing and grouting the riprap. Payment will be made at the contract unit price for Item 14, "Riprap - Grouted".

PART IV

SECTION VI. PIPE DRAINS (Items 15 to 22 incl.)

TP6-1. VITRIFIED CLAY PIPE (Items 15 to 19, incl.). - a. Work included. - The Contractor shall lay vitrified clay pipe with closed joints, including specials, of the required diameters for the drainage system along the landside-toe of the dike as shown on the drawings.

b. Materials. - All pipes shall be bell-and-spigot, vitrified clay pipe, conforming to the requirements of Federal Specification SS-P-361a, Extra-Strength, Chemical-Resistant Perforated and Standard Strength. Extra-strength pipe shall have perforations as detailed on the drawings with holes spaced approximately 3 inches on centers measured on the outside surface of the pipe. Each pipe shall be carefully inspected immediately before laying, and no cracked, broken or otherwise imperfect pipe shall be used, except for minor defects, which, in the opinion of the Contracting Officer, do not impair the fitness of the pipe for the purpose intended.

c. Excavation. - Excavation shall be done as shown on the drawings and as specified in Paragraph TP2-5. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe will be firmly supported on the bottom and for at least 3 inches up each side. Where encountered, rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids filled with well-compacted suitable material.

d. Laying pipe. - All pipe shall be placed in the trenches immediately after excavation is completed, except that perforated pipe shall be laid in screened gravel, with the perforations in the position as shown on the drawings. Proper care shall be taken in handling the pipe to avoid injury and breakage. The pipe shall be carefully bedded and properly connected and jointed. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipe shall be laid true to the lines and grades shown on the drawings or staked in the field, with bells upgrade and with spigot ends fully entered into the bells. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used shall meet the requirements of Paragraphs TP7-4 and TP7-6. The spigots shall be centered in the bells, and there shall be no shoulders or unevenness along the invert of the pipes. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout to center the pipe. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. Mortar joints shall be protected from the sun by a covering of wet burlap or moist earth over the top third of the pipe. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar and other obstructions.

e. Backfilling. - (1) Standard pipe. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be in accordance with the provisions of paragraph TP5-3.

(2) Extra-strength perforated pipe. - Backfill material shall be suitably graded screened gravel having a maximum size of 2 inches, and conforming to the requirements of Paragraph TP5-2. The gravel shall be placed around and over the pipe to the limits shown on the drawings or as directed.

f. Measurement and payment. - Measurement will be made by the linear foot for the amount of pipe of the various sizes installed. Payment for pipe shall include all costs of furnishing and installing the pipe, including specials, except the cost of excavation and backfilling. Payment will be made at the applicable contract unit prices for Items 15 to 19, inclusive, "Vitrified Clay Pipe".

TP6-2. REINFORCED CONCRETE PIPE (Items 20 to 22 incl.) - a. Work included. - The Contractor shall lay reinforced concrete pipe with mortar joints, including specials, of the required diameter for the drainage lines as shown on the drawings.

b. Materials. - Reinforced concrete pipe shall be circular bell-and-spigot or tongue-and-groove and shall conform to A.S.T.M. Designation: C 75-41 for "Standard Reinforced - Concrete Sewer Pipe".

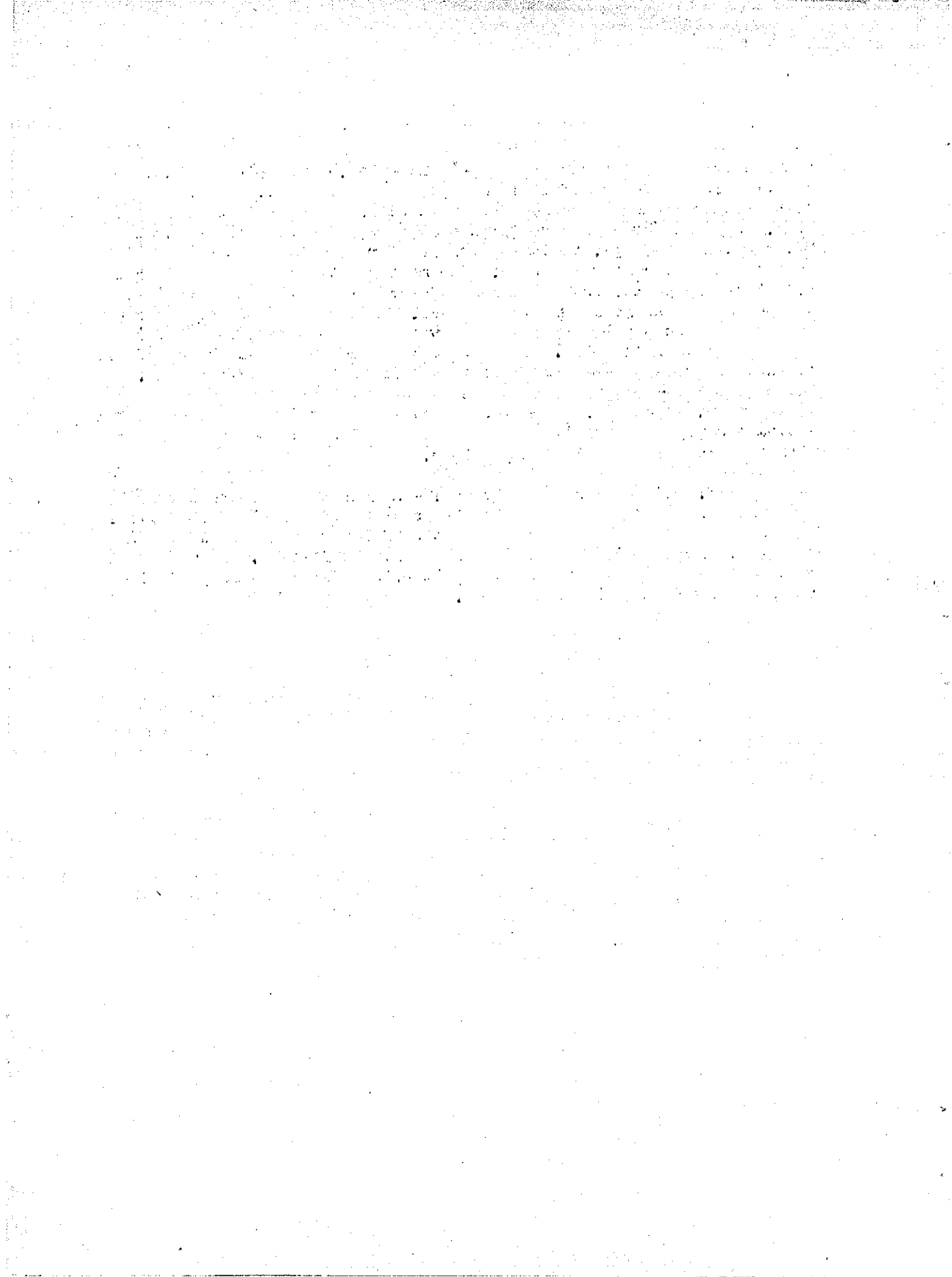
c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph TP2-5. Pipe trenches shall have a width at least 2 feet greater than the outside diameter of the pipe. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe except as otherwise shown on the drawings, so that the pipe will be firmly supported on the bottom and for at least 3 inches up each side. Where encountered, rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with well compacted suitable material.

d. Laying pipe. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded, and properly connected and jointed. Bell or groove holes shall be excavated to insure that each pipe will rest firmly upon its bed for the entire pipe length. The pipe shall be laid true to the lines and grades shown on the drawings or as staked in the field. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable plastic mortar shall be used. Cement and sand used in mortar shall meet

the requirements of Paragraphs TP7-4 and TP7-6. The spigots shall be centered in the bells, if bell and spigot pipe is used, and there shall be no shoulders and unevenness of any kind along the bottom half of the pipe. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout to center the pipe. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. Mortar joints shall be protected from the sun by a covering of wet burlap or moist earth over the top third of the pipe. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar and other obstructions.

e. Backfill. - Backfill shall be evenly spread and compacted around the pipe. Backfill over the pipe shall be placed in accordance with the provisions of Paragraph TP5-3.

f. Measurement and payment. - Measurement will be made by the linear foot for the amount of pipe of the various sizes installed. Payment for pipe shall include all costs of furnishing and installing the pipe, except the cost of excavation and backfilling. Payment will be made at the applicable contract unit prices for Items 20 to 22 inclusive, "Reinforced Concrete Pipe".



PART IV

SECTION VII. CONCRETE (Items 23 to 25 incl.)

TP7-1. SCOPE OF THE WORK. - The work covered by this section consists of the manufacture, transporting, placing, finishing and curing of concrete in the structures included in these specifications.

TP7-2. COMPOSITION. - Concrete shall be composed of Portland cement, water, fine and coarse aggregate, and an air-entraining admixture. The design of concrete mixtures will be based on the water-cement ratio necessary to secure (a) a plastic, workable mixture suitable for the specific conditions of placement and (b), when properly cured, a product having durability, impermeability, and strength in accordance with all the requirements of the structures covered by these specifications. The mixtures will be designed by the Contracting Officer.

TP7-3. WATER CONTENT. - The water content of all concrete mixtures shall be the minimum necessary to properly place the mixture being used.

TP7-4. CEMENT. - a. General. - Bulk cement or cement in cloth or paper bags shall be used for this work, except that cement necessary for grouting, finishing, and patching purposes may be packaged.

b. Portland cement. - Portland cement shall conform to Federal Specification SS-C-192, Type II or Type IIA.

c. High-early-strength Portland cement. - High-early-strength Portland cement shall conform to Federal Specification SS-C-192, Type III or IIIA and shall be used only when specifically approved in writing by the Contracting Officer. Concrete made with such cement shall be subject to all applicable provisions of these specifications.

d. Special test requirements. - Cement will be sampled at the mill and/or at the site of the work. All tests will be made by, or under the supervision of the Government and at its expense. No cement shall be used until notice has been given by the Contracting Officer that the test results are satisfactory. If tests prove that a cement which has been delivered is unsatisfactory, it shall be promptly removed from the site of work.

e. Storage. - Immediately upon receipt at the site of the work, cement shall be stored in a dry, weather-tight and properly ventilated structure with adequate provisions for the prevention of absorption of moisture. All storage facilities shall be subject to the approval of the Contracting Officer. In order that cement may not become unduly aged after delivery, the Contractor shall use any cement which has been stored at the site for 60 days or more before using cement of lesser age. Any cement stored at project site over four (4) months shall not be used unless retest proves it to be satisfactory.

TP7-5. ADMIXTURES. - a. Air-entraining admixtures. - The air-entraining admixture shall consist of any approved substance or compound which will produce entrained air in the concrete as hereinafter specified. Approval of an admixture will be based on such tests as are appropriate for the structures covered by these specifications and for the aggregates proposed for use. Whether the air-entraining admixture is interground with the cement at the mill or added at the mixer, or both, shall be optional with the Contractor. The admixture and the cement proposed for use shall be selected well in advance of the time concrete placing is started and the Contractor shall provide facilities satisfactory to the Contracting Officer for the ready procurement of adequate test samples. The total calculated air content of that portion of the concrete containing aggregate smaller than 1-1/2-inch square mesh sieve will be 4.5 + 1.5 per cent of the volume of the concrete. If it is necessary to add an admixture at the mixer to produce the specified air content when the cement contains an admixture, the same admixture shall be used in both instances.

b. Other admixtures. - Corrective additions to remedy deficiencies in aggregate grading, or admixtures desired for any other purpose, may be used only with the written approval of the Contracting Officer.

c. Tests. - Tests of admixtures will be made by the Government in accordance with applicable Federal or A.S.T.M. Specifications or as otherwise prescribed by the Contracting Officer.

TP7-6. FINE AGGREGATE. - a. Composition. - Fine aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sands. If the fine aggregate is a combination of separately processed sizes, or a combination of natural and manufactured sands, the different components shall be batched separately or, subject to the written approval of the Contracting Officer, blended prior to delivery to the batching plant.

b. Quality. - Fine aggregate shall consist of hard, tough, durable, uncoated particles. The equipment and plant used in the production of the fine aggregate shall be designed for the production of aggregate conforming with the requirements of these specifications. The stipulated percentages of fines in the sand shall be obtained either by the processing of natural sand or by the production of a suitable graded manufactured sand. If manufactured sand is used, it shall be produced with equipment designed for producing this type of sand. The shape of



the particles shall be generally rounded or cubical and reasonably free from flat or elongated pieces. Rock which breaks down into thin, flat, elongated particles, regardless of the type of processing equipment used, will not be approved for use in the production of fine aggregate. A thin, flat, elongated particle is defined as a particle having a maximum dimension in excess of five times the minimum dimension. The fine aggregate shall conform to the following specific requirements:

(1) Grading. - Fine aggregate shall be well graded from fine to coarse and the gradation shall conform to the following requirements as delivered to the mixers or as incorporated in the mixed concrete:

<u>Sieve Designation</u> <u>U.S. Std. Square Mesh</u>	<u>Cumulative Percentage by Weight</u>	
	<u>Passing</u>	<u>Retained</u>
No. 4	95-100	0-5
No. 8	80-90	10-20
No. 16	55-75	25-45
No. 30	30-60	40-70
No. 50	12-30	70-88
No. 100	3.5-10	90-96.5

In addition to the grading limits shown above, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.40 or more than 2.90 and, during normal operations, the grading of the fine aggregate shall be controlled so that the fineness moduli of at least nine of ten test samples of the fine aggregate as delivered to the mixer shall not vary more than 0.10 from the average fineness modulus. The fineness modulus shall be determined by dividing by 100, the sum of the cumulative percentages retained on U. S. Standard Sieves Nos. 4, 8, 16, 30, 50 and 100. Any washing, screening, classifying, blending, batching or other operations on the sand required to meet this specification shall be done by the Contractor and the cost thereof shall be included in the contract unit price for the items of work in which the fine aggregate is used. At the option of the Contractor, fine aggregate may be separated into two or more sizes or classifications, but the resulting combined sand shall be of uniform grading within the limits specified above.

(2) Soundness. - Suitable tests and the service record will be used to determine the acceptability of the fine aggregate. In the event suitable tests and a service record, that are satisfactory to the Contracting Officer, are not available, as in the case of newly operated sources, the fine aggregate shall be subjected to such tests as are necessary to determine its acceptability for use in concrete for the proposed structures. The tests to which the aggregate will be subjected will include specific gravity, absorption, soundness in magnesium sulfate, petrographic analyses, freezing and thawing in concrete, alkali-aggregate reaction, and any other tests that are necessary to demonstrate that concrete of acceptable durability over a long period of years can be produced.

(3) Sampling. - All sampling of fine aggregate shall be in accordance with the applicable portions of Federal Specifications SS-A-281a, or as directed by the Contracting Officer. The source from which fine aggregate is to be obtained shall be selected well in advance of the time when the material will be required in the work. Samples of the fine aggregate, suitable to the Contracting Officer, shall be furnished at a point designated by the Contracting Officer at least forty-five (45) days in advance of the time when the placing of concrete is expected to begin. Unless otherwise specified, all test samples shall be taken under the supervision of the Contracting Officer and delivered to the designated point by the Contractor at his own expense. All tests will be made by, and under the supervision of the Government at its expense. Routine control tests and analyses of the fine aggregate at various stages in the processing operations will be made by the Government. The Contractor shall provide such facilities as the Contracting Officer may consider necessary for the ready procurement of representative test samples.

c. Storage. - Fine aggregate shall be stored in such a manner as to avoid the inclusion of any foreign materials in the concrete. The storage piles shall be constructed so as to prevent segregation. The deposition of the material in storage and its removal therefrom shall be done in such a manner as to result in increasing the uniformity of the grading insofar as is practicable. All fine aggregate shall remain in free draining storage for at least seventy-two (72) hours prior to use. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete at the rate specified in Paragraph TP7-10.

TP7-7. COARSE AGGREGATE. - a. Composition. - Coarse aggregate shall consist of gravel, crushed gravel, stone or a combination thereof.

b. Quality. - Coarse aggregate shall consist of hard, tough, durable and uncoated particles. The equipment and plant used in the production of coarse aggregate shall be designed for the production of aggregate conforming with the requirements of these specifications. When crushed aggregate is furnished, the dust shall be removed by adequate washing. The particle shape of the smallest size of crushed coarse aggregate shall be generally rounded or cubical, and the tolerance on flat and elongated particles in all sizes of the coarse aggregate shall be governed by the inherent placeability requirements of the structure in which the mixture is to be placed. A thin, flat and elongated particle is defined as a particle having a maximum dimension greater than five times the minimum dimension. Aggregate which has disintegrated or weathered badly, under exposure conditions similar to those which will be encountered by the structures under consideration, shall not be used. The coarse aggregate shall conform to the following specific requirements:

(1) Grading. - The coarse aggregate shall be well graded from fine to coarse. It shall be separated into the following specific size groups or on other sieves common to local practice which

provide the required number of separations and adequate control of the grading. The grading of the aggregate within the separated size groups shall be as follows:

Sieve Size U.S. Std. Sq. Mesh	Per Cent by Weight Passing Individual Sieves			
	No. 4 to 3/4"	3/4" to 1 1/2"	1 1/2" to 3"	3" to 6"
7"				100
6"				90-100
3"			90-100	0-15
2"			20-55	0-5
1 1/2"		90-100	0-10	
1"		20-45	0-5	
3/4"	90-100	0-10		
3/8"	30-55	0-5		
No. 4	0-5			

The maximum size of coarse aggregate to be used in the various parts of the work shall be 1 inch (square mesh openings).

(2) Soundness. - Suitable tests and the service record will be used to determine the acceptability of the coarse aggregate. In the event suitable tests and a service record, that are satisfactory to the Contracting Officer, are not available, as in the case of newly operated sources, the coarse aggregate shall be subjected to such tests as are necessary to determine its acceptability for use in concrete for the proposed structures. The tests to which the aggregate will be subjected will include specific gravity, absorption, Los Angeles Abrasion, soundness in magnesium sulfate, petrographic analyses, freezing and thawing in concrete, alkali-aggregate reaction, and any other tests that are necessary to demonstrate that concrete of acceptable durability over a long period of years can be produced.

(3) Sampling. - All sampling of coarse aggregate shall be in accordance with Federal Specifications SS-A-281a, or as directed by the Contracting Officer. The source from which coarse aggregate is to be obtained shall be selected well in advance of the time when the material will be required in the work. Adequate samples of coarse aggregate for all required tests shall be furnished at a point designated by the Contracting Officer at least forty-five (45) days in advance of the time when the placing of the concrete is expected to begin. Unless otherwise specified, all test samples shall be taken under the supervision of the Contracting Officer and delivered to the designated point by the Contractor at his expense. All tests will be made by and under the supervision of the Government at its expense. Routine control tests and analyses of the coarse aggregate at various stages in the processing operation will be made by the Government and the Contractor shall provide such facilities as the Contracting Officer may consider necessary for the ready procurement of representative test samples.

c. Storage. - Coarse aggregate storage piles shall be built in such a manner as to avoid the inclusion of any foreign material in the concrete and to prevent segregation and excessive breakage. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete at the rate specified in Paragraph TP7-10.

TP7-8. WATER. - Water used in mixing concrete shall be fresh, clean and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.

TP7-9. PROPORTIONING OF CONCRETE. - a. Control. - The proportion of all material entering into the concrete shall be as directed by the Contracting Officer. The Contractor shall provide all necessary equipment and plant to determine and control the actual amounts of material entering each batch. The proportions will be changed whenever, in the opinion of the Contracting Officer, such change is necessary in order to maintain the standard of quality required by these specifications.

b. Measurements. - All materials entering into the concrete shall be mechanically batched and measured by weight. One bag of cement will be considered as ninety-four (94) pounds in weight and one gallon of water as 8.33 pounds.

c. Cement content. - The cement content in the various schedule items of concrete will range from an approximate minimum of five to an approximate maximum of six bags per cubic yard, depending on the size, type, and gradation of aggregate used, and on the structural requirements as determined by the Contracting Officer.

d. Aggregate content. - Concrete mixes will be designed to use the largest size and the maximum amount of coarse aggregate available and placeable in the various parts of the structures and the aggregate plant will be designed on this basis.

e. Placeability. - The concrete mixtures which have been designed and tested in the laboratory will be adjusted in the field from time to time to meet the varying conditions encountered during construction. Unless otherwise provided, the concrete shall be so controlled that the slump at all times is kept between one and one-half (1-1/2) inches and three (3) inches when tested in accordance with A.S.T.M. Designation C-143.

TP7-10. BATCHING AND MIXING. - a. Equipment. - The Contractor shall provide at the site of the work a modern and dependable batch-type mixing. The equipment shall be capable of combining the aggregate, cement, admixture, and water into a uniform mixture within the time limit specified and of discharging this mixture without segregation. Adequate facilities shall be provided for accurate measurement and control of each of the materials entering the concrete. Any waste

resulting from faulty operation of batching equipment, over-batching of materials, or other causes will be charged to the Contractor. The complete plant assembly shall include provisions to facilitate the inspection of all operations at all times. All records and charts of the batching and mixing operation shall be prepared as required herein and shall become the property of the Government. The plant shall be subject to the approval of the Contracting Officer and shall conform to the following detailed requirements:

(1) The accuracy of the weighing equipment shall conform to the applicable requirements of Federal Specification AAA-S-121b for such equipment. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Periodic tests shall be made in the presence of a Government inspector, in such a manner and at such intervals as may be directed by the Contracting Officer. Upon completion of each check test, and before further use of the measuring or recording devices, the Contractor shall make such adjustments, repairs or replacements as may be required to secure satisfactory performance.

(2) Delivery of materials from the batching equipment shall be within the following limits of accuracy:

<u>Material</u>	<u>Per Cent by Weight</u>
Cement	1
Water	1
Aggregate smaller than 1-1/2" size	2
Aggregate larger than 1-1/2" size	3
Admixture (when batched separately)	3

The batchers shall be arranged to permit the convenient addition or removal of material. Batching equipment shall be so constructed and arranged that the sequence and time of discharge can be controlled to produce a ribboning and mixing of the aggregate and, wherever practicable, of the cement with the aggregate as the materials pass through the charging hopper into the mixer. This control shall be effected by the control of the batcher discharge gates.

(3) Each weighing unit shall include a visible, springless dial or equally suitable device which shall indicate the scale load at all stages of the weighing operation from zero to full capacity.

(4) In so far as practicable, the dial shall be in full view of the operator and the weighing equipment shall be arranged so that the operator may conveniently observe the operation of the batcher gates and the discharge of the materials.

(5) There shall be provided, an automatically printed record of the quantity of cement discharged from the batchers for each batch of concrete. The weight of the cement charged shall be recorded in pounds; the recorder shall be continuous and each batch shall be recorded separately. The interconnecting mechanism from the batcher to the recorder shall be locked and the key therefor turned over to the Contracting Officer.

(6) The batching plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregate and to change the weights of the materials being batched.

(7) The mechanism for delivering water to the mixers shall be such that leakage will not occur when the valves are closed. The filling and discharge valves for the water tank shall be so interlocked that the discharge valves cannot be opened before the filling valve is fully closed.

(8) The plant shall include a device suitable for proportioning air-entraining admixtures. The discharge mechanism of the device shall be interlocked with the batching or discharging operation of the aggregate or the water, so that the batching of the admixture will be automatic. The device shall be capable of ready adjustment to permit varying the quantity of admixture to be batched.

(9) The plant shall include a device for indicating and recording the number of batches mixed.

(10) Suitable facilities shall be provided for readily obtaining representative samples of aggregate from each of the batchers for test purposes.

(11) The mixing plant shall be equipped with suitable devices for obtaining representative samples of concrete for slump, unit weight and uniformity tests. All necessary platforms, tools and equipment for obtaining samples shall be furnished by the Contractor. Concrete specimens will be prepared from the mixtures used in the work and tested to determine the adequacy and accuracy of control of the materials entering into the concrete mix. Preparation, storage and testing of the specimens will be at the expense of the Government.

(12) There shall be provided on each mixer, an acceptable device to lock the discharge mechanism until the required mixing time has elapsed.

b. Mixing time. - The mixing time for each batch, after all solid materials are in the mixer drum, provided that all the mixing water shall be introduced before one-fourth ( $1/4$ ) of the mixing time has elapsed, shall be as follows:

<u>Capacity of Mixer</u>	<u>Mixing Time</u>
$1/2$ cubic yards, or smaller	1- $1/4$ minutes
$3/4$ to 1- $1/2$ cubic yards incl.	1- $1/4$ minutes
2 and 3 cubic yards	2 minutes
4 cubic yards	2- $1/2$ minutes

The mixing periods specified are predicated on proper control of the speed of rotation of the mixer and of the introduction of the materials, including water, into the mixer. The mixing time may be increased when, in the opinion of the Contracting Officer, the charging and mixing operations fail to result in the required uniformity of composition and consistency of the concrete or when test samples of concrete taken from three locations, such as front, center, and back of the mixer show a difference of more than ten (10) per cent in the sand-cement or water-cement ratios. The mixer shall revolve at a uniform speed for a minimum of twelve (12) revolutions after all materials have been placed in it. Mixers shall not be charged in excess of the capacity recommended by the manufacturer, nor shall they be operated at a speed in excess of that recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted. Should any mixer at any time produce unsatisfactory results, as determined by the Contracting Officer, its use shall be promptly discontinued until it is repaired or replaced.

c. Special equipment. - The use of transit, truck, or agitator mixed concrete, is authorized. The equipment and

methods to be used shall be approved by the Contracting Officer in writing. Concrete, so manufactured, shall comply in every respect with these specifications. The Contracting Officer may, at any time, reduce the size of batches, adjust batching sequences, mixing time or mixing speed, and make such changes as are deemed necessary to obtain concrete of the quality herein specified. Weighing and batching equipment shall conform specifically to requirements of sub-paragraphs TP7-10 a, TP-10 a, (1), (2), (3), (4), (6), (7), and (9), and except as covered therein, the use of such equipment for mixing and transporting concrete shall be in accordance with applicable portions of A.S.T.M. Designation C 94-44.

TP7-11. CONVEYING. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation, or loss of ingredients. There shall be no vertical drop greater than five (5) feet except where suitable equipment is provided to prevent segregation and where specifically authorized by the Contracting Officer. Belt conveyors, chutes or other similar equipment in which the concrete is delivered to the structure in a thin, continuously exposed flow, will not be permitted except for very limited or isolated sections of the work and only then if approved in writing by the Contracting Officer. Such equipment shall be arranged to prevent objectionable segregation.

TP7-12. PLACING. - a. General. - Concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around all reinforcement and embedded items without permitting the material to segregate. Concrete shall be deposited as close as possible to its final position in the forms so that flow within the mass and consequent segregation are reduced to a minimum. Placing of concrete shall, as far as practicable, be done by means of bottom-dump buckets of sufficient size to handle the full capacity of one mixer but not to exceed four (4) cubic yards capacity. The design of the buckets shall permit close regulation of the amount of concrete to be deposited in each dumping position. It is contemplated that the full capacity of a bucket may be deposited in one operation, but near forms or embedded items or elsewhere as directed by the Contracting Officer, the discharge shall be controlled so that the concrete may be effectively compacted into horizontal layers not exceeding eighteen (18) inches in thickness with a minimum of lateral movement and accompanying tendency for segregation and the formation of rock pockets. Free water shall be collected in depressions away from the forms and removed by bailing prior to placement of additional concrete. All concrete placing equipment and methods shall be subject to the approval of the Contracting Officer.

b. Time interval between mixing and placing. - Concrete shall be placed before initial set has occurred and, unless otherwise authorized by the Contracting Officer, before it has contained its water content for more than forty-five (45) minutes.

c. Placing temperature. - (1) Cold weather. - Concrete shall not be placed when the ambient temperature is below thirty-five (35) degrees F unless specifically approved, nor when the concrete



without special protection, is likely to be subjected to freezing temperatures before final set has occurred. If concrete is placed when the temperature is below thirty-five (35) degrees F., such placement will be directed by the Contracting Officer in writing, and the materials shall be heated in such a manner that they will be free of ice, snow, and frozen lumps, before entering the mixer. All methods and equipment for heating shall be subject to the approval of the Contracting Officer. Concrete, when deposited in the forms during cold weather, shall have a temperature of not less than forty (40) degrees F., nor more than sixty (60) degrees F., and shall, at all times, be delivered to the forms at the coolest temperature within the range specified which it is practicable to produce under the current conditions.

(2) Warm weather. - All concrete shall be delivered to the forms at all times at the coolest temperature which is practicable to produce under current conditions. Concrete placement will not be permitted when, in the opinion of the Contracting Officer, the sun, heat, wind, or humidity prevents proper placement and consolidation.

d. Concrete on earth foundations. - Unless otherwise authorized, all concrete shall be placed upon clean, damp surfaces free from frost, ice, standing or running water and never upon soft mud, dried porous earth or upon fills that have not been subjected to approved rolling and tamping until optimum compaction has been obtained. The Contractor shall take all measures necessary to accomplish the results contemplated in this paragraph.

e. Vibration of concrete. - Concrete shall be placed with the aid of mechanical vibrating equipment and supplemented by hand-spading and tamping. In no case shall vibrators be used to transport concrete inside the forms. The vibrating equipment shall be of the internal type and shall at all times be adequate in number of units and power of each unit to properly consolidate all concrete. Form or surface vibrators shall not be used unless specifically approved by the Contracting Officer. Internal vibrators shall maintain a speed of not less than 6,000 impulses per minute when in operation submerged in the concrete. The intensity (amplitude) of vibration shall be sufficient to produce satisfactory consolidation. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Insertion of the vibrator into lower courses that have commenced initial set or the disturbance of reinforcement embedded in concrete beginning to or already set, shall be avoided. Where absorptive form lining is used, the vibrator shall not be placed between the forms and the outer row of reinforcement and in no case shall the vibrator be allowed to come in contact with the absorptive form lining.

f. Placing concrete through reinforcement. - In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On the bottom of beams and slabs, where the congestion of steel near the forms makes placing difficult, a layer of mortar of the same cement-sand ratio as used in the concrete shall be first deposited to cover the surface to the extent directed by the Contracting Officer.

TP7-13. CONSTRUCTION JOINTS. - a. General. - After the top surface of a lift is finally compacted, it shall be immediately and carefully protected, for periods as determined by the Contracting Officer, from direct rays of the sun, pedestrian traffic, materials being placed thereon, running water, heavy rain, or any activity upon the surface, that in any manner will affect the setting of the concrete. Vertical and horizontal joints on exposed faces shall be chamfered or formed to produce a uniform and neat appearance as indicated on the contract drawings or as directed by the Contracting Officer.

b. Cleaning. - Horizontal construction joints on lifts with relatively open and accessible surfaces may be prepared for receiving the next lift by either wet sandblasting or by cutting with an air-water jet, as specified below. However, approved wet sandblasting equipment shall be provided. If the surface of a lift is congested with reinforcing steel, is relatively inaccessible, or if for any other reason the Contracting Officer considers it undesirable to disturb the surface of a lift before final set has taken place, surface cutting by means of air-water jets will not be permitted and the use of wet sandblasting will be required. All excess water shall be removed from the surface of construction joints before the new concrete is placed thereon. After surfaces have been prepared to the satisfaction of the Contracting Officer, all approximately horizontal surfaces shall be covered by a layer of mortar of the same sand-cement ratio as the concrete. Concrete shall then be placed immediately upon the fresh mortar.

(1) Air-water cutting. - Air-water cutting of a construction joint shall be performed at the proper time after initial set has taken place but before the concrete has obtained its final set. The surface shall be cut with a high pressure air-water jet to remove all laitance and to expose clean, sound aggregate, but not so as to undercut the edges of the larger particles of aggregate. The air pressure used in the jet shall be one-hundred (100) pounds plus or minus five (5) pounds and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. The surface shall again be washed with an air-water jet just prior to placing the succeeding lift. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, wet sandblasting may be required immediately before placing the next lift to supplement air-water cutting.

(2) Wet sandblasting. - When employed in the preparation of construction joints, wet sandblasting shall be performed immediately before placing the following lift. The operation shall be continued until all unsatisfactory concrete, and all laitance, coatings, stains, debris, and other foreign materials are removed. The surface of the concrete shall then be washed thoroughly to remove all loose material.

(3) Waste disposal. - The method used in disposing of waste water employed in cutting, washing and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor or affect exposed surfaces of the structures. Methods of disposal will be subject to the approval of the Contracting Officer.

TP7-14. FINISHING. - Immediately after removal of forms or absorptive form lining, all unsightly ridges or lips shall be removed and undesirable local bulging on the surfaces shall be remedied. Excessive rubbing of formed surfaces will not be permitted. All voids and holes left by the removal of tie rods shall be reamed and neatly filled with dry-patching mortar (pre-shrunk) mixed in the proportions directed by the Contracting Officer. The cement used in the mortar shall be a blend of Portland Cement and White Portland Cement properly proportioned so that the final color of the cured mortar will be the same as the color of the surrounding concrete. Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely in place. Concrete for patching shall be drier than the usual mixture and shall be thoroughly tamped into place. All finishing, filling of voids and tie-rod holes and patching of exposed surfaces shall be performed immediately after the forms are removed, unless otherwise authorized or directed by the Contracting Officer. All unformed surfaces of concrete that are not to be covered by additional concrete or backfill, shall have a wood float finish without additional mortar and shall be true to elevation as shown on the drawings. Care shall be taken to see that all excess water is removed before making any finish. Other surfaces shall be brought to the specified finished elevation and left true and regular. Where indicated on the drawings, joints shall be carefully made with a jointing tool. Every precaution shall be taken by the Contractor to protect finished surfaces from stains or abrasions. Surfaces or edges likely to be injured during the construction period shall be properly protected.

TP7-15. CURING AND PROTECTION. - a. General. - All concrete shall be cured for a period of not less than fourteen (14) consecutive days by an approved method or combination of methods applicable to local conditions, except that the curing period may be reduced to seven (7) days for concrete made with high-early-strength cement. The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. The curing medium used shall be approved in writing by the Contracting Officer and shall be applied, so as to prevent checking and cracking and loss of moisture from all the surfaces of the concrete, immediately after placing. The curing medium shall be maintained so as to prevent detrimental loss of water from the concrete for the duration of the entire curing period. Unhardened concrete shall be protected from heavy rains, flowing water, or the direct rays of the sun. All concrete shall be adequately protected from mechanical injury. No fire or excessive heat shall be permitted near or in direct contact with concrete at any time. All galleries, conduits and other formed openings through the concrete shall be closed during the entire curing period and as long thereafter as practicable to prevent circulation of air and resultant checking and drying of the concrete.

b. Cold weather. - Concrete placed during cold weather shall be kept sufficiently moist at all times during curing period to prevent detrimental loss of water from the concrete. The air in contact with the concrete shall be maintained at temperatures between fifty (50)

degrees and seventy (70) degrees F., by suitable covering and heating for at least the first five (5) days, and at a temperature above freezing for the remainder of the specified curing period. The temperature protection equipment and the removal of forms shall be handled in such a manner that the surface concrete will not be subjected to a sudden drop in temperature of more than twenty-five (25) degrees F., as determined by observation of ambient and concrete surface temperatures indicated by suitable thermometers, furnished by the Government and installed outside of the concrete and two (2) inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor at his expense and at such locations as may be directed by the Contracting Officer. Salt, chemicals or other materials shall not be mixed with the concrete to prevent freezing.

c. Water curing. - Concrete, if cured with water, shall be kept wet by covering with an approved, water-saturated material or by a system of perforated pipes or mechanical sprinklers or by any other approved method which will keep all surfaces continuously (not periodically) wet. Where forms of tongue-and-groove lagging are used and left in place for curing, they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and free from any elements which, in the opinion of the Contracting Officer, might cause objectionable staining or discoloration of the concrete.

d. Saturated sand curing. - Horizontal construction joints and finished surfaces cured with sand shall be covered with a minimum thickness of one (1) inch of sand which shall be kept uniformly distributed and continuously saturated during the curing period applicable to the surface being cured.

e. Curing compounds. - Curing compounds, where used, shall be of the surface membrane type, of composition and characteristics in accordance with Corps of Engineers Guide Specifications, "Specifications for Curing Concrete by Means of Membrane Compounds". The use of curing compounds on any surface shall be subject to the approval of the Contracting Officer. Curing compounds shall not be used on surfaces to which additional concrete is to be bonded. In cold weather, curing compounds shall not be used on concrete surfaces which are maintained at curing temperature by the use of steam pipes. Curing compounds proposed for use on any vertical surface must be specifically approved in writing by the Contracting Officer.

TP7-16. FORMS. - a. Material. - Forms shall be of wood, steel, or other approved material except that sheeting for all exposed surfaces, where absorptive form lining is not specified, or otherwise authorized, shall be tongue-and-groove lumber of uniform width. Form lining having a glazed, water-tight surface will not be permitted for exposed concrete surfaces or for surfaces where severe weathering or severe hydraulic cavitation or erosion may be experienced. The type, shape, size, quality and strength of all materials of which the forms are made shall be subject to the approval of the Contracting Officer.

b. Construction. - Forms shall be true to line and grade, mortar-tight and sufficiently rigid to prevent objectionable deformation under load. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Responsibility for their adequacy shall rest with the Contractor. The form surfaces shall be smooth, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged, that when the forms are removed, all metal will be not less than two (2) inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and where discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. All exposed joints shall be chamfered and suitable moulding shall be placed to bevel or round exposed edges or corners, including the use of dummy chamfers and false joints to provide a neat and uniform appearance, unless otherwise indicated on the drawings or directed by the Contracting Officer.

c. Coating. - Forms for exposed surfaces, except those lined with absorptive form lining, shall be coated with non-staining mineral oil which shall be applied shortly before the concrete is placed. After oiling, surplus oil on the form surfaces and any oil on the reinforcing steel or other surfaces requiring bond with the concrete, shall be removed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

d. Removal. - Forms shall not be removed without the approval of the Contracting Officer, and all removal shall be accomplished in a manner which will prevent injury to the concrete. When forms are removed under conditions of a wide differential of temperature between the concrete and the atmosphere, provision, satisfactory to the Contracting Officer, shall be made for maintaining a blanket of moist air adjacent to the concrete and thus gradually reducing the temperature differential between the concrete and the surrounding atmosphere. A temperature differential of less than twenty-five (25) degrees F., will be required. (This differential will be determined as in Paragraph TP7-15 b.) Forms shall not be removed before the expiration of 2 days, except as otherwise directed or specifically authorized by the Contracting Officer.

e. Absorptive form lining. - (1) Quality. - The forms for the exposed surfaces of head walls shall be lined with an absorptive form lining of approved quality. The form lining shall remain in place after removal of the forms to provide a blanket of moisture on the surface and to serve as a protection for the concrete surface against staining or abrasion during the curing period. The form lining shall be highly absorptive to air and water, and shall be readily and completely removable from the concrete surface at the end of the curing period. The form lining shall, through its absorptive capacity, eliminate voids, pits and other common defects of the surface of the concrete placed against it, and shall produce a dense concrete surface of texture satisfactory to the Contracting Officer. The lining shall be easily cut

and fitted, and shall be readily adaptable to any other operation necessary to its use. The lining itself and any treatment employed in its manufacture shall not discolor the concrete or interfere with the normal chemical reaction of the cement in the concrete.

(2) Tests. - The type of lining used shall be subject to the approval of the Contracting Officer. Tests shall be made by the Contractor of all proposed absorptive lining as directed by the Contracting Officer. These tests shall include the use of absorptive form lining on concrete surfaces which will later be covered with backfill. Samples shall also be furnished to the Government for laboratory tests for any type of lining having no previous service record before such lining will be approved.

(3) Installation. - Absorptive form lining shall be attached to the forms in such a manner as to hold the lining snugly in contact with the surface of the forms, free from bulging and other imperfections that might cause unevenness or roughness of the concrete surface. Nails, tacks, or staples, if used, shall be driven in a uniform pattern and shall be flush with the surface of the absorptive form lining. Care shall be taken not to make dents in the surface of the lining with the hammer or in any other manner. After the absorptive form lining has been attached to the form, the joints shall be rubbed with a smooth tool to press down any projecting material. The locations and directions of joints in absorptive form lining shall be as directed or approved by the Contracting Officer. For cutting and trimming the absorptive lining, the Contractor shall use tools which are well adapted to this type of work, and are maintained in such condition that smooth edges will be produced. The joints between the sheets of absorptive form lining shall be finished smoothly and accurately, and patching of the sheets will not be permitted. At joints, the edges of the form lining shall be in contact but shall not be pressed tightly together. The Contractor shall avoid splashing mortar or concrete on the absorptive lining, and shall replace sheets of lining which have been damaged. Absorptive form lining shall be used only once and after being used shall be removed from the site. At all times subsequent to the delivery of the form lining and prior to placing the concrete against the lining, the Contractor shall take all precautions necessary to protect the lining from becoming damp or wet to such an extent as to reduce its effectiveness as an absorptive medium. Particular care shall be exercised to protect absorptive form lining during clean-up operations and temporary protection of such linings will be required. The use of absorptive form lining which has become wet or which contains visible external defects such as holes, ragged or untrue edges, breaks, cracks, tears, protuberances or indentations will not be permitted.

TP7-17. STEEL REINFORCEMENT. - a. General. - The Contractor shall cut, bend and place, in accordance with the drawings prepared by the Contractor and approved by the Contracting Officer, all steel reinforcement including rods, fabric and structural shapes. All reinforcement shall be, when surrounding concrete is placed, reasonably free from loose flaky rust and scale, and free from oil, grease or other coating which might destroy or reduce its bond with the concrete. The Contractor shall furnish drawings showing bending details and placing schedules of all steel reinforcement, for approval by the Contracting Officer.

b. Cutting and bending. - Steel reinforcement may be mill or field bent. All bending shall be in accordance with standard approved practice and by approved machine methods.

c. Quality. - Steel reinforcement shall be of new billet, intermediate grade, open-hearth steel, deformed, and shall conform to Federal Specification QQ-B-71a for "Bars, Reinforcement, Concrete, Type B, Grade 2 dated January 12, 1938". Certified copies of mill tests required shall be furnished by the Contractor and the steel shall be subjected to such tests as the Contracting Officer may consider necessary to establish its quality, including particularly the requirements of bending and elongation. The steel shall be free from oil, paint, dirt or excessive rust.

d. Spacing of Bars. - The spacing of bars shall be as shown on the contract drawings or as directed by the Contracting Officer.

e. Relation of bars to concrete surfaces. - The minimum cover for all main reinforcement shall conform to the dimensions shown on the drawings. The dimensions, as shown on the drawings, will indicate the clear distance from the edge of the main reinforcement to the concrete surface. The concrete covering of stirrups, spacer bars, and similar secondary reinforcement may be reduced by the diameter of such bars.

f. Splicing. - All splices in reinforcement shall be as shown on the drawings or as directed by the Contracting Officer. The lapped ends of bars shall be either separated sufficiently to permit the embedment of the entire surface of each bar in concrete or connected as a single continuous bar to develop the full strength of the bar.

g. Supports. - All reinforcement shall be secured in place by use of metal or concrete supports, spacers or ties, as approved by the Contracting Officer. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such manner that they will not be exposed or contribute in any way to the discoloration or deterioration of the concrete.

h. Protection for future use. - Exposed reinforcement, intended for bonding to future work, shall be protected from corrosion by heavy wrapping of burlap saturated with a bituminous material. Reinforcement so protected shall be thoroughly cleaned prior to subsequent concrete placing.

TP7-18. EMBEDDED ITEMS. - Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings or required by the Contracting Officer. All embedded items shall be thoroughly clean and free of oil and other foreign matter such as loose coatings of rust, paint, and scale. The embedding of wood in concrete shall be avoided unless specifically directed or authorized by the Contracting Officer. Metal shall be used instead. Any air or water lines or other materials embedded in structures, as construction expedients authorized by the Contracting Officer, shall conform to the above requirements and



upon completion of their use, shall be backfilled with concrete or grout as directed by the Contracting Officer.

TP7-19. INSTALLATION OF TEST APPARATUS. - The Contracting Officer reserves the right to install pressure cells, stress meters, thermometers and other test apparatus in the foundations and in various parts of the structures for the purpose of making physical measurements and observations. All technical labor, materials, equipment and supplies for this purpose will be furnished by the Contracting Officer. All common labor, materials, equipment and supplies shall be furnished by the Contractor. Installations by the Contracting Officer will be conducted in such a manner as to offer minimum interference with the operations of the Contractor. The Contractor shall conduct his operations in such a manner as to protect the apparatus from injury or displacement.

TP7-20. MEASUREMENT AND PAYMENT. - a. Concrete. - Measurement of concrete will be made on the basis of the actual volume of concrete within the neat lines of the structures as indicated on the drawings or as otherwise required. Measurement of concrete placed against the sides of any excavation without the use of intervening forms will be made only within the neat lines of the structure. No deductions will be made for rounded or beveled edges or space occupied by metal work, electrical conduits or timber, nor for voids or embedded items which are either less than five (5) cubic feet in volume or one (1) square foot in cross-section. Unless otherwise specified, payment for concrete will be made at the respective contract prices per cubic yard for the various items of the schedule, which price shall include the cost of the admixture; of required unloading, handling and storage at the site of all cement used in the work; of all labor; and of the use of all equipment, tools and materials required to complete the concrete work; except the cement, reinforcement and embedded parts which are specified to be paid for separately. No payment will be made for concrete, as such, which is placed in structures for which payment is made as a lump sum. The bidding schedule item for concrete under this contract is as follows:

Item (24) Concrete. This item included all concrete placed as indicated on the drawings listed in Paragraph SC-4 b of the specifications. Payment therefor will be made at the contract unit price per cubic yard for Item 24, "Concrete".

b. Portland cement. - The quantity to be paid for under Item 23, "Portland Cement", will be the number of barrels (376 pounds net weight) of cement actually used in all parts of the work unless specifically excepted, wasted or used for the convenience of the Contractor.

c. Reinforcement. - Measurement of reinforcement will be made of the lengths of bars actually placed in accordance with the drawings or bar schedules approved by the Contracting Officer, or in accordance with the instructions of the Contracting Officer. The measured lengths will be converted to weights for the size of bars listed by the use of the unit weights per lineal foot stated in Federal Specifications Q-B-71a, 1-5. Steel in laps indicated on the drawings or required by the Contracting Officer will be paid for at the contract unit price. No payment will be made for the additional steel in laps which are authorized for the convenience of the Contractor. Furnishing and placing reinforcement bars will be paid for at the contract unit price per pound for Item 25, "Steel Reinforcement".



d. Absorptive form lining. - Payment for furnishing, installing and removing absorptive form lining will be included in the contract price for Item 24, "Concrete".

## PART IV

### SECTION VIII. MISCELLANEOUS WORK (Items 26 to 33 inclusive)

TP8-1. MISCELLANEOUS IRON (Item 26). - a. Work included. - The Contractor shall install manhole frames, covers and steps at the manhole structures as shown on the drawings or required.

b. Materials. - (1) Gray-iron castings for manhole frames, covers and steps shall conform to the requirements of Federal Specification QQ-I-652. Unless otherwise shown on the drawings, the castings shall be a standard commercial pattern suitable for the purpose.

(2) New castings, before being shipped from the foundry, shall be given one coat of coal-tar-pitch varnish applied in a satisfactory manner to form a smooth, tenacious coating. The coating shall not become brittle after drying or have any tendency to scale off the castings.

c. Measurement and payment. - Measurement will be made by the pound for the amount of miscellaneous iron furnished and installed in accordance with the drawings and specifications. Wherever practicable, the quantities shall be determined by weighing the articles and materials on the most accurate scales available. The weight will be determined by the Contracting Officer who may use, in his discretion for that purpose, scale weights, railroad shipping weights, manufacturers' weights, catalog weights, or computed weights. The weight of all tare, packing and blocking will be deducted and only net weights shall be used for payment quantities; provided, that no payment will be made for any weight in excess of 5 per cent more than the computed weight as determined from the drawings. Payment will be made at the contract unit price for Item 26, "Miscellaneous Iron", and shall include all costs of furnishing and installing the manhole frames, covers and steps, as specified and in accordance with the detail drawings.

TP8-2. FOUNDATION RELIEF WELLS (Items 27 and 28). - a. Work included. - The Contractor shall install the foundation relief wells as shown on the drawings and in accordance with these specifications and in the locations shown on the drawings. Each relief well as shown on the drawings shall consist of a pervious or screen section, a riser pipe section, and a discharge section. The pervious section at the base of the well shall consist of a 6-inch I.D. vitrified clay perforated pipe which serves as a water filter. The riser section shall consist of a 6-inch I.D. vitrified clay pipe which shall connect through a tee section with an 6-inch vitrified clay lateral discharge pipe, thence by means of 6-inch V. C. elbow into the vitrified clay toe drain piping or directly into a concrete manhole as shown on the drawings. The top of the well shall be capped so as to be accessible for cleaning. The wells shall be equipped with a permanent mandrel and flushing pipe of 1-1/4-inch wrought-iron pipe.

(2) Relief wells. - (a) Construction of relief wells shall be accomplished by driving an 18-inch O.D. casing and removal of overburden materials within the casing by an approved means consistent with good practice. The casing shall be progressively lowered and cleaned out until the desired grade of the bottom of the well is reached. The pipe and mandrel assembly shall be lowered inside the casing with joints made as specified above. The casing shall be withdrawn in conjunction with simultaneous backfilling with clean gravel around the pipe to the point corresponding to the bottom elevation of the gravel toe drain. In order that cavities may not remain in the gravel fill and to hold the pipe firmly in position, the Contractor shall prod the gravel at intervals, during placement, with a wooden rod. The lateral connection to the toe drain shall then be made. The area surrounding the bell-and-spigot pipe making up the remainder of the well shall be carefully backfilled with random material with a plug of impervious material at the elevation shown. Any damage to the vitrified clay pipe or mandrel pipe shall be repaired by the Contractor at no additional expense to the Government.

(b) Adequate provision shall be made by the Contractor to control the spoil of washing operations so that damage to the dike or roads will not result.

c. Measurement and payment. - Payment for foundation relief wells will be made under Items 27 and 28 as follows:

(1) Item 27 - Foundation Relief Wells Complete - Total Depth 18 feet. - Payment shall include all work required to install, complete, each well to a total depth of 18 feet, measured from the top of the mandrel pipe cap to the bottom of a theoretical well 18 feet below. Included in the above are furnishing and installing all vitrified clay pipe including lateral connection, 6-inch V.C. elbow, mandrel pipe, cast-iron plugs, pipe collar, pipe cap and tee; and excavation and backfill at top of well and all necessary casing washing and gravel backfilling required to provide a complete well of theoretical total length of 18 feet. Payment will be made at the contract unit price for Item 27, "Foundation Relief Wells, Complete, Total Depth 18 Feet". See payment detail on Drawing Number CT-4-3396.

(2) Item 28 - Foundation Relief Wells - Additional Depth. - Measurement will be made by the linear foot of well extended below the theoretical complete well as described in subparagraph TP8-2 e (1) above. Payment shall include all costs required to install each linear foot of 18-inch gravel-packed well, including, casing, excavation within casing, pipe, mandrel pipe, removal of casing and backfilling with gravel. Payment will be made at the contract unit price for Item 28, "Foundation Relief Wells, Additional Depth".

TP8-3. BROACH AND REPAIR CAST IRON PIPE (Item 29). a. Work included. - The Contractor shall cut, remove, and replace a section of the cast-iron pipe at Sta. 65 + 67+. The pipe consists of one 30-inch pumping station discharge conduit serving as a gravity sanitary sewer outfall during periods of low river stage. The existing cast iron pipe is bell-and-spigot. The length of the pipe removed and replaced shall be as approved by the Contracting Officer, and shall be of sufficient length for the placing of steel sheet piling under the pipe. As soon as practicable before the entire completion of the installation of steel sheet piling, or immediately after, the Contractor shall replace the section of pipe removed.

b. Control of water and sewage. - The Contractor shall make all necessary provisions for the maintenance of satisfactory operation of the existing conduit, throughout the construction period. This conduit is under the jurisdiction of the Town of West Springfield and the Contractor shall make all necessary arrangements with the town authorities regarding this operation. The Contractor shall install any temporary sewer extensions and connections, including necessary valves and specials to divert the sewage away from the work. The installation of any temporary-sewer extensions and connections shall include all shoring, excavation, backfill and other incidental work required in connection therewith.

c. Broaching of lines. - The lines may be cut or opened at joints as the Contractor may elect. Breaks or cuts shall be clean and sharp and the work shall be performed by skilled workmen.

d. Repair of lines. - As soon as practicable, following the placing of steel sheet piling, the conduit shall be restored by the replacement of the sections removed. The joints or cut lines shall be tightly caulked in accordance with standard practice of the trade and the replaced section shall be accurately fitted to the line and grade of the existing pipe.

e. Payment. - Payment will be made at the contract price for Item 29, "Broach and Repair Cast Iron Pipe", and shall include all costs required for broaching and replacing sections of the conduit, including cutting and removing sections in the line, maintenance of services, control and diversion of water and sewage, and replacement of the pipes.

TP8-4. TOPSOIL (Item 30). - a. Work included. - The Contractor shall place topsoil to the compacted thickness shown on the drawings on the riverside and landside areas indicated on the drawings.

b. Materials. - (1) Topsoil shall consist of fertile, friable, natural topsoil, as approved by the Contracting Officer. It shall be reasonably free from stumps, roots, hard lumps, stones greater than 1 inch in diameter, noxious weeds, sticks or other litter. It

shall contain from 5 per cent to 20 per cent of organic matter by weight, determined as loss on ignition of oven-dried samples. Prior to stripping, the topsoil shall have demonstrated its suitability by the occurrence upon it of healthy crops, grass or other vegetative growth.

(2) Topsoil shall be obtained from approved stored materials salvaged from stripping and required excavations, and from other approved outside sources as directed by the Contracting Officer. The Contractor shall submit for approval the proposed outside sources at least two weeks in advance of contemplated use and shall assist in obtaining samples. If after testing of the samples, this topsoil is found unsatisfactory for the seed and fertilizer applications specified, the material will be rejected unless the Contractor agrees to apply additional soil amendments and fertilizer of the type and amount needed to make the proposed topsoil suitable at no additional cost to the Government. Excavation from stockpiles shall be regulated to obtain suitable topsoil as approved by the Contracting Officer.

c. Placing topsoil. - After the general excavation, fills and grading have been completed to the required grades and sections under other items, the Contractor shall apply the stored topsoil or additional acceptable topsoil from approved sources, to the specified depth when compacted over the required areas to the limits shown on the drawings. Placing topsoil shall be done only when it may be permissibly followed soon after by fertilizing and seeding. Where areas are to receive topsoil, the compacted subgrade shall be scarified to a depth of 2 inches for the bonding of soil with subsoil. Topsoil is then to be evenly spread, compacted and graded to the thickness and to the elevations and slopes as shown on the drawings. The topsoil shall be lightly rolled or tamped, and any unevenness of surface shall be corrected to conform to finished grades.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of topsoil actually placed in accordance with directions, measured in place after compaction, whether obtained from stockpiles or from other sources. Payment shall include the costs incidental to furnishing, sorting, hauling and placing the topsoil. Payment will be made at the contract unit price for Item 30, "Topsoil".

TP8-5. FERTILIZING AND SEEDING (Item 31). - a. Work included. - The Contractor shall fertilize and seed the areas topsoiled as shown on the drawings.

b. Time of fertilizing and seeding. - All seed shall be sown, when directed by the Contracting Officer, to insure the greatest possible protection against erosion. Unless specifically directed otherwise or further limited by the Contracting Officer, seed for permanent grass shall be sown only in the periods of April 1 to June 15 and August 20 to October 1. After the latter date in each period, temporary cover crops shall be sown. Permanent seeding shall be performed in the next growing period.

c. Material and application rates. - (1) Fertilizer and soil amendments shall be applied in the order shown below with the types of materials and application rates specified as follows:

<u>Materials</u>	<u>Rate per acre</u>
Ground limestone (dolomitic)	1000 lbs.
Superphosphate 20%	750 lbs.
Organic Fertilizer	1000 lbs.

Organic fertilizer shall be derived from organic materials which may be cottonseed meal, castor bean, soy bean meal, or Milorganite, and shall contain a minimum of 5.5 per cent of nitrogen.

(2) Seed mixture shall conform to the following:

<u>Pure Live Seed</u>	<u>Minimum Percentage of Mixture by Weight</u>
Canada Blue	13
Orchard Grass	15
Chewings Fescue or Red Fescue	27
Red Top	15
Domestic Rye Grass	5
	75
Other Material (maximum)	25
	100

Application Rate - 150 pounds per acre

The 25 per cent. of other material shall be a mixture consisting of nonviable seed, chaff, hulls, live seeds of crop plants other than those specified above, and harmless inert material and weed seeds not exceeding 1 per cent by weight of the total mixture. Seeds which have become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

(3) Seed mixtures shall contain seeds of the previous year's crop and shall be packed in bags, labeled with weight of seed contained, and shall be tagged to show the composition in accordance with the applicable State and Federal seed laws. For the fertilizer, certificates shall be furnished indicating the guaranteed percentages of nitrogen available, phosphoric acid, water-soluble potash, the percentage of the total nitrogen derived from organic materials and the net weight and time of shipment. At least 5 weeks and not over 16 weeks prior to the starting of seeding operations, the Contractor shall furnish labor and facilities for taking of test samples from the seed and fertilizer delivered to the site, which will be taken by representatives of the Contracting Officer and boxed for shipment to the Soils Laboratory, New England Division, Corps of Engineers, War Department, Watertown Arsenal, Building 39, Watertown, Mass. Samples from any other source will not be considered.

d. Fertilizing procedure. - Lime shall be applied as a first application, evenly spread at the specified rates over the areas to be seeded, and well worked into the full depth of the topsoil with disc harrows. Superphosphate shall be applied with the lime or separately thereafter and shall be well worked into the top 4 inches of the topsoil. After mixing in the lime a period of 5 days shall be allowed to elapse before applying fertilizer. As a final application, and shortly before seeding, the fertilizer shall be applied over the harrowed surface and well worked into the top 2 inches of the soil with combination plankers and wire-mesh drags or similar devices to prepare a seed bed.

e. Seeding procedure. - (1) Preparation of seed bed. - Immediately before sowing seed the Contractor shall harrow the soil to a depth of  $3/4$  inch by using iron rakes or spring-tooth harrows. Finished surface grade shall be maintained in a true and even condition during the sowing operation. Sticks, stones over 1 inch in diameter, hard lumps, large roots, weeds, trash, and other litter appearing at the surface shall be removed. To the fullest extent practicable, harrowing in of fertilizer and preparation of the soil shall be done in the direction parallel to the contour lines of the slope (not uphill or downhill).

(2) Method of sowing. - The Contractor shall take advantage of favorable weather and soil condition and shall sow the seed mixture by means of mechanical hand seeders at the rate indicated. The seed shall be sown over the areas topsoiled and fertilized as shown on the drawings or as specified. Seed shall be worked into the soil with a brush drag and the surface compacted with a cultipacker or light hand roller. Direction of the travel of the brush drag and cultipacker or light hand roller shall be parallel to the contour of the slope in so far as is practicable.

(3) Mulching. - Upon completion of the rolling, the surface of all seeded slopes shall be protected against erosion by an application of a light top mulch. Material for the mulch shall be a type not easily displaced by wind and shall consist of hay cut on or near the site, humus, forest litter, or commercial third grade hay. Mulch shall be applied at a uniform thickness of one half ( $1/2$ ) inch. If hay is used, the rate of application shall be two tons per acre. The mulch shall be spread over the surface of the seeded areas in a complete and continuous blanket. Mulching shall start at the top of the slope and continue downward until the whole area is covered. The mulch shall be held in place by stakes driven into the slopes at six foot intervals or fastened as directed by the Contracting Officer.

(4) Maintenance and reseeding. - The Contractor shall maintain the areas sown with the specified grass seed until all work in the entire contract has been completed and accepted by the Contracting Officer. This maintenance shall consist of mowing twice yearly with a scythe or mechanical mower, wetting during periods of drought, and removal of large and conspicuous weeds or other similar maintenance operations when required by the Contracting Officer. Surfaces gullied or otherwise damaged shall be replaced with topsoil, fertilized and reseeded to establish specified results.

f. Measurement and payment. - Measurement will be made by the acre for the actual superficial areas fertilized and seeded within the limits shown on the drawings and as approved by the Contracting Officer. Payment will be made at the contract unit price for Item 31, "Fertilizing and Seeding", and shall include all costs incidental to the work and the specified maintenance. No additional payment will be made for provision of temporary cover crops.

TP8-6. PIEZOMETERS (Item 32). - a. Work included. - The Contractor shall install piezometers at the locations and to the lines and grades shown on the drawings. The exact locations of the piezometers will be staked in the field.

b. Materials. - (1) Pipe shall consist of 1-1/2-inch, standard weight, galvanized wrought-iron pipe corresponding to Federal Specification WW-P-441a, Class A.

(2) Valve box and cover shall be cast iron and shall consist of the top section only of a standard manufactured valve box assembly similar and equal to Part Number F-2455 as manufactured by the Clow National Company. The cover shall be blank.

(3) Concrete. - The concrete slab mounting shall be constructed of materials as specified in Section VII.

(4) Grout shall consist of 1 part Portland cement and 2-1/2 parts sand by volume combined with sufficient water to form a workable, plastic mixture.

(5) Gravel shall be bank-run of a gradation as specified in Paragraph TP5-1.

c. Construction methods. - The piezometer pipe shall be driven vertically to the required elevation and the material within the pipe washed out completely. Should the washings indicate that the material is relatively impervious at the bottom elevation shown on the drawings, the Contracting Officer may direct that the piezometer pipes shall be extended until pervious material is encountered, the additional length not to exceed 6 feet. The gravel base, concrete slab and valve box shall then be placed in a workmanlike manner. The concrete slab shall be formed on the sides. The forms shall be removed and the ground around the finished installation shall be restored to its original condition. Surplus material shall be removed.

d. Payment. - Payment shall include all costs, regardless of the length of the individual piezometers, including any additional length required up to 6 feet greater than that shown on the drawings. Payment will be made at the contract unit price for Item 32, "Piezometers".

TP8-7. FENCE (Item 33). - a. Work included. - The chain-link fence indicated on the drawings shall be removed by the Contractor to facilitate the construction operations under this contract. After



the completion of the work, the Contractor shall replace the 6-foot fence with acceptable salvaged material from the original fence or with new fence of the same description. All other required accessories shall be included and the entire replacement of the fence shall be accomplished in a practicable manner to a satisfactory completion of the work for the purpose intended.

b. Payment. - Payment for all work, materials, and incidentals required for the removal and replacing of the chain-link fence will be made at the contract price for Item 33, "Fence". No partial payment will be made for this item.

TP8-8. CLEANING UP. - a. Work included. - (1) The Contractor shall clean up the site of the work and restore all portions of the dike and adjacent property damaged by construction operations to an acceptable condition, and remove rubbish and temporary structures.

(2) The Contractor shall remove all ramps constructed for use during the construction progress of the work.

(3) Replacement of topsoil and reseeding of portions of the existing dike and adjacent ground, damaged by construction operations, and not included within the actual payment limits of Items 30 and 31, shall be made. All work in connection with this topsoil, fertilizing and reseeding shall be accomplished in accordance with all applicable provisions of Paragraphs TP8-4 and TP8-5.

b. Payment. - No separate payment will be made for labor, materials, or incidentals involved in clean-up work, but payment therefor shall be included in the various items of the work to which it pertains.

Bid No.  
Serial No. 19-016-47-27

BID

(CONSTRUCTION CONTRACT)

Date:

To: New England Division  
Corps of Engineers, War Department  
31 St. James Avenue  
Boston 16, Mass.

Project: CONSTRUCTION OF WEST SPRINGFIELD DIKE - FOUNDATION TREATMENT,  
STATION 56+87 TO AGAWAM BRIDGE, WESTFIELD RIVER, MASSACHUSETTS

In compliance with your invitation for bids dated 10 March 1947,  
the undersigned hereby proposes to furnish all plant, labor, materials  
and equipment and perform all work for the above-described project in  
strict accordance with the specifications, schedules, drawings and ad-  
denda numbered -

for the consideration of the following unit prices;

SCHEDULE A

Item No.	Estimated Quantities	Unit	Description of Item	Unit Price	Estimated Amount
1	-	job	Clearing the Site		
2	4,100	sq.yd.	Stripping		
3	600	sq.yd.	Removal and Replacement of Existing Riprap and Gravel Bedding		
4	12,000	cu.yd.	Common Excavation - General		
5	1,700	cu.yd.	Common Excavation - Cut-off Trench		
6	800	cu.yd.	Common Excavation - Imper- vious Borrow		
7	19,400	sq.ft.	Steel Sheet Piling		
8	1,700	cu.yd.	Impervious Fill		
9	30	cu.yd.	Gravel Bedding		

(Bid Form) 1

Item No.	Estimated Quantities	Unit	Description of Item	Unit Price	Estimated Amount
10	3,400	cu.yd.	Screened Gravel		
11	5,800	cu.yd.	Backfill - Compacted		
12	3,900	cu.yd.	Backfill - Semi-Compacted		
13	60	cu.yd.	Riprap - Hand-placed		
14	20	sq.yd.	Riprap - Grouted		
15	4,000	lin.ft.	Vitrified Clay Pipe: 12-inch - Extra-Strength (Perforated)		
16	600	lin.ft.	Vitrified Clay Pipe: 15-inch - Extra-Strength (Perforated)		
17	400	lin.ft.	Vitrified Clay Pipe: 18-inch - Extra-Strength (Perforated)		
18	400	lin.ft.	Vitrified Clay Pipe: 21-inch - Extra-Strength (Perforated)		
19	400	lin.ft.	Vitrified Clay Pipe: 24-inch - Extra-Strength (Perforated)		
20	50	lin.ft.	Reinforced Concrete Pipe: 18-inch		
21	1,000	lin.ft.	Reinforced Concrete Pipe: 30-inch		
22	2,500	lin.ft.	Reinforced Concrete Pipe: 36-inch		
23	370	bbl.	Portland Cement		
24	270	cu.yd.	Concrete		
25	9,500	lb.	Steel Reinforcement		
26	18,000	lb.	Miscellaneous Iron		
27	112	each	Foundation Relief Wells, Complete, Total Depth 18 Feet		

(Bid Form) 2

Item No.	Estimated Quantities	Unit	Description of Item	Unit Price	Estimated Amount
28	1,640	lin.ft.	Foundation Relief Wells, Additional Depth		
29	-	job	Broach and Repair Cast Iron Pipe		
30	1,700	cu.yd.	Topsoil		
31	2.0	acre	Fertilizing and Seeding		
32	12	each	Piezometers		
33	-	job	Fence		
TOTAL					

#### SCHEDULE B

Item No.	Estimated Quantities	Unit	Description of Item	Unit Price	Estimated Amount
1	-	job	Clearing the Site		
2	4,100	sq.yd.	Stripping		
3	Deleted				
4	12,000	cu.yd.	Common Excavation - General		
5	Deleted				
6	Deleted				
7	Deleted				
8	Deleted				
9	30	cu.yd.	Gravel Bedding		
10	3,400	cu.yd.	Screened Gravel		
11	5,800	cu.yd.	Backfill - Compacted		
12	3,900	cu.yd.	Backfill - Semi-Compacted		
13	Deleted				
14	20	sq.yd.	Riprap - Grouted		

(Bid Form) 3

Item No.	Estimated Quantities	Unit	Description of Item	Unit Price	Estimated Amount
15	4,000	lin.ft.	Vitrified Clay Pipe: 12-inch - Extra-Strength (Perforated)		
16	600	lin.ft.	Vitrified Clay Pipe: 15-inch - Extra-Strength (Perforated)		
17	400	lin.ft.	Vitrified Clay Pipe: 18-inch - Extra-Strength (Perforated)		
18	400	lin.ft.	Vitrified Clay Pipe: 21-inch - Extra-Strength (Perforated)		
19	400	lin.ft.	Vitrified Clay Pipe: 24-inch - Extra-Strength (Perforated)		
20	50	lin.ft.	Reinforced Concrete Pipe: 18-inch		
21	1,000	lin.ft.	Reinforced Concrete Pipe: 30-inch		
22	2,500	lin.ft.	Reinforced Concrete Pipe: 36-inch		
23	370	bbl.	Portland Cement		
24	270	cu.yd.	Concrete		
25	9,500	lb.	Steel Reinforcement		
26	18,000	lb.	Miscellaneous Iron		
27	112	each	Foundation Relief Wells, Complete, Total Depth 16 Feet		
28	1,640	lin.ft.	Foundation Relief Wells, Additional Depth		
29	Deleted				
30	1,700	cu.yd.	Topsoil		

(Bid Form) 4

Item No.	Estimated Quantities	Unit	Description of Item	Unit Price	Estimated Amount
31	2.0	acre	Fertilizing and Seeding		
32	12	each	Piezometers		
33	-	job	Fence		
TOTAL					

# PLANT AND EQUIPMENT SCHEDULE

## Available Plant To Be Used

### Pumping Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

### Concreting Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

### Excavating Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

### Miscellaneous Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

The bidder agrees, upon receipt of written notice of an award of the contract within sixty (60) days after the date of opening of the bids, that he will execute W. D. Contract Form No. 2, in accordance with this bid as accepted, and if the consideration of the contract will exceed \$2,000 in amount will furnish to the Government a performance bond on U. S. Standard Form No. 25 or U. S. Standard Form No. 25-B and a payment bond on U. S. Standard Form No. 25-A or U. S. Standard Form No. 25-C with good and sufficient surety or sureties, as required by the specifications, at the time that the contract is executed.

The bidder further agrees that if awarded the contract he will commence the work within fifteen (15) calendar days after the date of receipt by him of notice to proceed, provide the plant and equipment as set forth in the PLANT AND EQUIPMENT SCHEDULE, and that he will fully complete the work ready for use not later than one hundred and eighty (180) calendar days after the date of receipt by him of notice to proceed.

It is hereby warranted that in the event award is made to the undersigned there will be furnished under this contract, or used in the performance of the work covered by this contract, only such unmanufactured articles, materials, and supplies as have been mined or produced in the United States and only such manufactured articles, materials, and supplies as have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States, except as noted below or otherwise indicated in this bid or authorized in the invitation.

Security (bid bond - U. S. Standard Form No. 24) if required by the invitation is inclosed.

By \_\_\_\_\_

\_\_\_\_\_  
(Title)

\_\_\_\_\_  
(Business Address)

NOTE: If the bidder is a corporation, indicate State of Incorporation under signature; and if a partnership, give full names of all partners.